

# AVIATION WEEK

A MCGRAW-HILL PUBLICATION

JUNE 27, 1955

50 CENTS

## The First Production-Line Airborne Transistors Fly on the F11F

THE Grumman F11F Tiger represents a significant advance in carrier-borne fighters—for a number of important reasons.

Not the least of these are her low drag characteristics—the result of a wasp-waisted fuselage and high density design.

Important, too, is a new instrumentation feature, her Honeywell Transistor Fuel Measurement System—first transistorized production-line device to fly.

The new Transistor Fuel Gage has all the accuracy of the famous Honeywell electron-tube gage, but is lighter, smaller, and requires less than half the power. It has been flight tested extensively on many commercial and military aircraft.

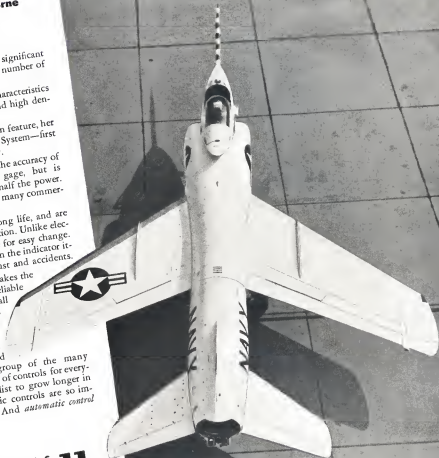
Transistors have an exceptionally long life, and are extremely resistant to shock and vibration. Unlike electron tubes, they needn't be accessible for easy change. In the new gage they are sealed within the indicator itself—hermetically protected from dust and accidents.

The long-life characteristic also makes the new transistorized gage the most reliable available today. Designed to meet all military specifications, it operates from minus 65° to 160° F.

Electronic Fuel Measurement Systems for aircraft and missiles—including the new transistorized version—represent only one group of the many Honeywell products in our line of controls for everything that flies. We expect the list to grow longer in future years—because automatic controls are so important to aviation progress. And automatic control is Honeywell's business.

MINNEAPOLIS  
**Honeywell**  
Aeronautical Division

2600 Ridgway Road, Minneapolis 13, Minn.



another first

## a miniature floating anchor nut

# KAYLOCK

ALL METAL SELF-LOCKING NUTS



Kaylock sets the pace again for the self-locking nut industry with this all new precision full floating anchor nut which exceeds the performance requirements of Air Force-Navy specifications.

For more information, mail coupon today.

The Kaylock Company Dept. K-4  
P.O. Box 2050, Terminal Annex  
Los Angeles 54, California

Please send me the following:

\_\_\_\_\_ Additional Technical Data  
\_\_\_\_\_ Samples  
\_\_\_\_\_ Standard  
\_\_\_\_\_ Minimum  
\_\_\_\_\_ Ask price representative or to sell

Name \_\_\_\_\_  
Position \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

• **smallest** Less than 1/4" size of conventional floating anchor nut

• **lightest** One-third the weight of conventional floating anchor nut

• **strongest** In torque-out, push-out, and military requirements

• **interchangeable** with fixed dimensions without any loose rivet size Same rivet hole spacing

DESIGNED KEYS

# B.F. Goodrich

FIRST IN RUBBER



## WORLD'S FIRST ALL TUBELESS AIRLINER is B. F. Goodrich equipped!

TUBELESS TIRES are now flying the Taperway. This United DC-6B Monoliner is the first plane to be completely Tubeless equipped and CAA approved for scheduled, commercial service. And it's equipped by B. F. Goodrich, inventor of the Tubeless Tire.

Goodrich pay load is one of the big advantages in switching to this new tire design. B. F. Goodrich Tubeless Tires on this airplane represent a weight reduction of approximately 40 pounds under regular tires and tubes.

In addition, B. F. Goodrich Tubeless Tires save time and money in ware-

housing and maintenance. Instead of a tire and tube, there's only the tire to purchase and stock—only the tire to remove and service. And the exclusive BFG designed tread design distributes and loads more evenly, gives slower wear and less road cutting.

There are specific safety features, too: no tube to chafe or kink—no tube to bunch or shift during take-offs and landings. A patented inner liner, built as an integral part of the B. F. Goodrich Tubeless Tire itself, replaces the conventional tube and retains correct inflation pressure much longer.

The B. F. Goodrich Tubeless Tire for commercial planes is the flying mate of two other BFG airplane Tubeless Tires, the high pressure Tubeless Tire used by jet fighters and the world's first 300 mph Tubeless Tire. All three are typical examples of B. F. Goodrich leadership in Tubeless Tire research and development. The B. F. Goodrich Co., Aeronautical Sales, Akron, Ohio.

## B. F. Goodrich

FIRST IN RUBBER



Severe weight . . . Ideal  
for measured online

In addition, Lode-Clad saves weight by permitting use of smaller controls, pulleys and supporting frames. Sensitivity in the control system is increased by practically eliminating cable curve changes and brings easy, uniform control. Its smooth surface fits perfectly through pressurized cabin stuffing boots.

### Engineering Service

Contact our Engineering Department for data and suggestions on complete Lock-Clad Control Cable Assemblies. John A. Bobbing's Sons Corporation, Trenton 8, New Jersey.

## Aviation Week

JUNE 22, 1955

YOM. 62. 403 34

#### Editorial Offices

New York 34-110 W. 41st St., Phone 1-Duquesne 6-3000 (Night 1-0) 4-3000

Yoshigaki, A. & C.—National Press Bldg., Phone National 8-11

Los Angeles 17—(H) Wilbur Hod, Phone 66420

Table of Contents, on Page 8

54,500 cases of this virus existed

Robert W. Munn, Jr.	Publisher
Robert E. Hale	Editor

Alpha W. Jorg		Managing Editor	
David A. Auderick	Engineering	William J. Conklin	West Coast
James Shaw	Technical	Bruce Long	West Coast Analysis
L. E. Chastain	Equipment, Maintenance		
Kenneth Johnson	Congress	Henry Lohr	New Delhi
Phyllis Kline	Construction	William J. Cusky	New Delhi
Gladis D. Wiser	Military	G. J. McMillen	Washington News
Craig Lewis	Transport	Lorenzini / Stark	Art Editor
Errol Stone	Transport	William G. Mosley	Editorial Manager
Patricia J. Sullivan	Business Plans	Victor R. Keller	Printing & Production

## DOMESTIC NEWS BRIEFS

Atlanta 5	801 Modern Flamingo Bldg.	Boston 25	1000 Federalist Bldg.
Chicago 11	510 N. Michigan Ave.	Los Angeles 17	1111 Wilshire Blvd.
Cleveland 15	1510 Hanna Bldg.	San Francisco 4	— 55 Post St.
Detroit 26	355 President Bldg.	Washington 4	1230 National Press Bldg.

## TOWSON NEWS SERVICE

Editor	John Wilkins	Massachusetts City	John H. Conway
London	Edo and W. S. Hall	Rue de Jussieu	Peter Wooley
Paris	John O. Conway	Tokyo	Don Knuth
Post	David W. Schneider	Stuttgart	Carsten Grottel

**Research and Marketing:** Louis Nohden, Mary Whitney Fortson, Jeanne Rabinovich, and Michael Bala

J. G. Johnson      Eugene M. Singer

T. B. Choe, *President/Manager* M. V. Corleau, *Prediction Manager*  
Sales Representatives in: J. C. Anthony, New York; R. P. Johnson, Cleveland; D. T. Dyer and J. S. Corleau, Chicago and St. Louis; E. F. Blanchard, Boston; James Cash, Dallas; William D. Lauer, Jr., Atlanta; E. Dean Wyckoff, San Francisco; G. McReynolds and Carlos Jones, Los Angeles; W. S. Kliney, Philadelphia; C. A. Remick, Detroit. Other offices exist in Pittsburgh, London.

AVIATION WEEK • JUNE 27, 1988 • Vol. 62, No. 24  
Member: AEP and ABC

[illegible]

## Small gas turbines pass test of time

**New Milestones Gain Industry-wide Acclaim for AirResearch Power Turbines**

AirResearch small gas turbine engines, first of this revolutionary class of turbofans, have now passed the following important milestones:

- 100 000 hours of actual service in the field
- Successful operation up to altitudes of 55 000 feet
- Completely reliable automatic control on wind

- Customer established overhaul periods of up to 400 hours on existing units
- Design overhaul periods on new models of 1000 hours
- All phases of military qualification (including new shaft power and gas turbine component designs)

Progress in this field. As research in fact is directed and directed combined.

tion tests capable of delivering either shaft or bleed air power independently of each other. Allresearch has more experience with small gas turbines than all other manufacturers combined.

We are proud of the engineering-manufacturing team that has made possible these outstanding contributions to industry.



CORPORATION

AllResearch Manufacturing Divisions

Los Angeles 92, California • Thomas, Science

*Polycrystalline and amorphous forms of silicon carbide* (see also 65080, 65081, 65082, 65083, 65084, 65085, 65086, 65087, 65088, 65089, 65090, 65091, 65092, 65093, 65094, 65095, 65096, 65097, 65098, 65099, 65100, 65101, 65102, 65103, 65104, 65105, 65106, 65107, 65108, 65109, 65110, 65111, 65112, 65113, 65114, 65115, 65116, 65117, 65118, 65119, 65120, 65121, 65122, 65123, 65124, 65125, 65126, 65127, 65128, 65129, 65130, 65131, 65132, 65133, 65134, 65135, 65136, 65137, 65138, 65139, 65140, 65141, 65142, 65143, 65144, 65145, 65146, 65147, 65148, 65149, 65150, 65151, 65152, 65153, 65154, 65155, 65156, 65157, 65158, 65159, 65160, 65161, 65162, 65163, 65164, 65165, 65166, 65167, 65168, 65169, 65170, 65171, 65172, 65173, 65174, 65175, 65176, 65177, 65178, 65179, 65180, 65181, 65182, 65183, 65184, 65185, 65186, 65187, 65188, 65189, 65190, 65191, 65192, 65193, 65194, 65195, 65196, 65197, 65198, 65199, 65200, 65201, 65202, 65203, 65204, 65205, 65206, 65207, 65208, 65209, 65210, 65211, 65212, 65213, 65214, 65215, 65216, 65217, 65218, 65219, 65220, 65221, 65222, 65223, 65224, 65225, 65226, 65227, 65228, 65229, 65230, 65231, 65232, 65233, 65234, 65235, 65236, 65237, 65238, 65239, 65240, 65241, 65242, 65243, 65244, 65245, 65246, 65247, 65248, 65249, 65250, 65251, 65252, 65253, 65254, 65255, 65256, 65257, 65258, 65259, 65260, 65261, 65262, 65263, 65264, 65265, 65266, 65267, 65268, 65269, 65270, 65271, 65272, 65273, 65274, 65275, 65276, 65277, 65278, 65279, 65280, 65281, 65282, 65283, 65284, 65285, 65286, 65287, 65288, 65289, 65290, 65291, 65292, 65293, 65294, 65295, 65296, 65297, 65298, 65299, 65300, 65301, 65302, 65303, 65304, 65305, 65306, 65307, 65308, 65309, 65310, 65311, 65312, 65313, 65314, 65315, 65316, 65317, 65318, 65319, 65320, 65321, 65322, 65323, 65324, 65325, 65326, 65327, 65328, 65329, 65330, 65331, 65332, 65333, 65334, 65335, 65336, 65337, 65338, 65339, 65340, 65341, 65342, 65343, 65344, 65345, 65346, 65347, 65348, 65349, 65350, 65351, 65352, 65353, 65354, 65355, 65356, 65357, 65358, 65359, 65360, 65361, 65362, 65363, 65364, 65365, 65366, 65367, 65368, 65369, 65370, 65371, 65372, 65373, 65374, 65375, 65376, 65377, 65378, 65379, 65380, 65381, 65382, 65383, 65384, 65385, 65386, 65387, 65388, 65389, 65390, 65391, 65392, 65393, 65394, 65395, 65396, 65397, 65398, 65399, 65400, 65401, 65402, 65403, 65404, 65405, 65406, 65407, 65408, 65409, 65410, 65411, 65412, 65413, 65414, 65415, 65416, 65417, 65418, 65419, 65420, 65421, 65422, 65423, 65424, 65425, 65426, 65427, 65428, 65429, 65430, 65431, 65432, 65433, 65434, 65435, 65436, 65437, 65438, 65439, 65440, 65441, 65442, 65443, 65444, 65445, 65446, 65447, 65448, 65449, 65450, 65451, 65452, 65453, 65454, 65455, 65456, 65457, 65458, 65459, 65460, 65461, 65462, 65463, 65464, 65465, 65466, 65467, 65468, 65469, 65470, 65471, 65472, 65473, 65474, 65475, 65476, 65477, 65478, 65479, 65480, 65481, 65482, 65483, 65484, 65485, 65486, 65487, 65488, 65489, 65490, 65491, 65492, 65493, 65494, 65495, 65496, 65497, 65498, 65499, 65500, 65501, 65502, 65503, 65504, 65505, 65506, 65507, 65508, 65509, 65510, 65511, 65512, 65513, 65514, 65515, 65516, 65517, 65518, 65519, 65520, 65521, 65522, 65523, 65524, 65525, 65526, 65527, 65528, 65529, 65530, 65531, 65532, 65533, 65534, 65535, 65536, 65537, 65538, 65539, 65540, 65541, 65542, 65543, 65544, 65545, 65546, 65547, 65548, 65549, 65550, 65551, 65552, 65553, 65554, 65555, 65556, 65557, 65558, 65559, 65560, 65561, 65562, 65563, 65564, 65565, 65566, 65567, 65568, 65569, 65570, 65571, 65572, 65573, 65574, 65575, 65576, 65577, 65578, 65579, 65580, 65581, 65582, 65583, 65584, 65585, 65586, 65587, 65588, 65589, 65590, 65591, 65592, 65593, 65594, 65595, 65596, 65597, 65598, 65599, 65600, 65601, 65602, 65603, 65604, 65605, 65606, 65607, 65608, 65609, 65610, 65611, 65612, 65613, 65614, 65615, 65616, 65617, 65618, 65619, 65620, 65621, 65622, 65623, 65624, 65625, 65626, 65627, 65628, 65629, 65630, 65631, 65632, 65633, 65634, 65635, 65636, 65637, 65638, 65639, 65640, 65641, 65642, 65643, 65644, 65645, 65646, 65647, 65648, 65649, 65650, 65651, 65652, 65653, 65654, 65655, 65656, 65657, 65658, 65659, 65660, 656

© 2000 THE UNIVERSITY OF CHICAGO. ALL RIGHTS RESERVED. NO PART OF THIS PUBLICATION MAY BE REPRODUCED OR TRANSMITED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM THE UNIVERSITY OF CHICAGO PRESS.

# GFR\*

**NOW**... a new fabrication technique  
for production of jettable fuel tanks  
and other aircraft and missile components  
from non-critical materials

DESIGN • DEVELOPMENT • PRODUCTION

**PASTUSHIN**  
AVIATION CORP. Los Angeles, Calif.

\*GLASS FIBER • RESIN

Engineers: If you are not now employed in a defense industry, submit resume.

## NEWS DIGEST



McDONNELL F-101 VOODOO takes off with three external fuel tanks during simulated "heavy-weight condition" flight tests. Location of fuel tanks on the fuselage Air Force fighter's design was dictated by inability of the Voodoo's thin wing to support big tanks. Photographs on the ends of fuel tanks may be drop valves. Also note manual chute on F-101's for its "wing tail" elevator.

### Domestic

**Patt & Whitney Aircraft** is modifying a Douglas C-124 to take the T37 helicopter in the nose as a flying test bed for first flight tests of the gas-turbine engine. T37, standardized to power the Douglas C-130, 50-ton payload transport, is now racing in the test stand but has not yet undergone the required 150-hour off test type test.

**The Ford Motor Co.** has now contracts to build F8-WA 197 turboprop engines at Dorchester, Mass., for Air National Guard. The contract, with a total value of \$195,372,597, will for production of 765 powerplants. Three versions are included J7725W, 21 and .19W.

**Fairchild Engine & Airplane Corp.'s** Aircraft Division received a USAF contract for 75 more C-121Bs. The award increases to nearly 240 the number of aircraft swappable scheduled for production at Fairchild's Hagerstown, Md., plant. Air Force now, except its first fully operational C-121s today (June 27). The plane will be used by USAF's first fixed-wing assault transport unit, the 104th Troop Carrier Group, to be activated next month at Air Force AF, Okla.

**Pan American World Airways** ordered Model AVQ 90 C-46s to replace older four-engine C-46s. The new aircraft will be used by PAA's contract of DC-6s and DC-7s. Value of the contract \$1 million.

**Northwest Orient Airlines** is testing Boeing X-400 subsonic order on a 747 passenger flight on a Boeing Strato-cruiser. Evaluation will cost approximately \$40,000, including installation, a spare and test equipment. It is expected for NWA's fleet, the price will be about \$14,000 per plane plus \$6,000 for each installation.

**Cornell-East** Wirth was awarded a modification for Air Force contract to convert 36 Air Force C-54s to an engine configuration. Conversion to SC-54 calls for larger fuel tanks, navigation and engine search devices, heater windows and engine equipment. First phase is scheduled for delivery next fall.

**Tanker tests** will begin on Boeing Airplane Co.'s Model 707 jet tank-transport prototype this summer at Seattle. Installation of flight refueling equipment has started on the jet and is expected to take several weeks.

**Kaiser Metal Products, Inc.** will build additional B-57 wings for Glenn L. Martin Co. under a new \$10 million contract. The second contract production of B-57 wings at Kaiser's Bristol, Pa., plant through July 1958.

### Financial

**Nathany Aircraft, Inc.** reported net income of \$5,990,162 for the nine months ended April 30, a nearly five-fold increase over \$1,014,156 for the same period last year. Contrib-

uted sales and other income totaled \$21,917,385, compared with \$10,645,905 last year. Building Air Force B-57s, compared with \$10 million last year and \$59 million a year ago.

**Kyle Aeronautical Co.'s** net earnings during the first half of fiscal 1957 declined to \$796,596 from \$1,094,885 for the comparable six-month period last year. Net sales and other income was \$10,444,115, compared with \$23,344,351. Working April 30 dropped to \$12.6 million from \$10 million last year.

### International

**South Korean Air Force** received four North American F-100 Sabers from USAF last week, the Republic's first U.S. fighter aircraft. At least three squadrons are expected to be transferred during the next year. Deliveries awarded South Korea's military aircraft to 144 in North Korea, according to reports from the Communist side have 235 MC-15s.

**Pacific Western Airlines** took a 30-day option to buy Queen Charlotte Harbor, a seaplane base after years of tough competition between the two rival British Columbia carriers. Announcement of the proposed merger came shortly after QCA President A. J. Spalding reported earlier PWA overtures (AW June 6, p. 7). Purchase price was understood to be well over \$1 million.

**125,000 psi**  
**shear** *hi-shear*  
**rivets**

**31% STRONGER IN SHEAR**  
**THAN MAX BOLTS—**  
**PENSIVE LOOK TO AN OUTS**

**900° F. HEAT RESISTANT**  
**FOR AREAS OF ENGINE**  
**HEAT AND SKIN FRICTION**

**TOPS FOR FASTENING**  
**17-7PH AND TITANIUM**  
**MATERIALS**



**AVAILABLE IN**  
**1/8, 3/16, 1/2, 5/8, 3/4 DIAMETERS—**  
**OVERSIZE 1/32 AND**  
**1/64 FOR SALVAGE**



31% and 100% shear strength. \* Titanium rivets only.

**hi-shear** MEET YOUR COMPANY  
RIVET SUPPLY NEEDS—CALL 1-800-368-3683

## The Aviation Week

June 27, 1955

### Management

USAF in Speed F-100, F-104 Outputs 32  
New Goals for Defense Plans 33  
Allen Industries Schedule Changes 34  
Navy Depots 35  
Industry Observer 36  
U.S. War 37  
Washington Roundup 38

### Aeronautical Engineering

Turkey Enters Jet Age 39  
Supersonic SEF-1 Details Revealed 40  
British Destroyer for West Coast 41  
French Fly Bombs, Battle Fighters 42  
American Withdraws Open Turbine 43  
Terror & Drug 44

### Air Transport

SAF Plans Atlantic Cargo Subsidies 45  
Lockheed Offers New Airframe 46  
State Studies Federal City 47  
General Electric Engine Program 48  
CAA Test Aircraft 49  
British Airways Industry Plan 50  
Project in Shortened ATA President 51  
Solutions Will Seek Rules Agreement 52  
Pan American Aviation, The CAA Support 53  
CAA Search for in Private Case 54  
CAA Review 55

### Production

Falcons Use Beam Drill, Heavywork 56  
Cleveland Makes for F-100 57

### Avionics

Theory of Field Effect Transistor 58  
Aviation Electronics Job Outlook 59  
Aviation Electronics 60  
Fiber Optics 61

### Business Flying

Rock Should Double as Jet to Fall 62  
Private Lines 63

### Financial

New Aircraft Order Log Continued 64  
New Contracts 65  
Buyer Comments 66  
USAF Contracts 67

### Equipment

New Aviation Products 68

### Aviation Safety

Our Engineer Promotes Jet Fuel 69

### Editorial

The Fairness of Government 70

Calendar 71



## TOPP POTENTIOMETERS



Until now, you've seen Topps' precision potentiometers only as integral parts of the widely used Topps Machine and calibrating devices and single contact instruments.

Now, expanded production makes these highly reliable potentiometers available to all manufacturers of electronic equipment.

Topps potentiometers have an outstanding record of high reliability. The full line includes the most modern designs in linear and non-linear types; single turn, rectilinear motion and multi-turn, with servo flange, threaded backing and tapped hole mounts. A custom design and manufacturing service is available for unusual needs.

Bring your potentiometer problems to TOPP. Write or visit for information and potentiometer catalog.



INDUSTRIES, INC.

3250 West 120th St., Los Angeles 45, California

## WHO'S WHERE

### In the Front Office

Gen. Benjamin Chaffee, retired command, Air Defense Command, appointed command advisor and consultant to the president of The Aviation Products, Inc.—Chaffee last.

Joe Lopez Valdez returned to Calicut de Avionics as president. During Lopez's delay a letter of choice, administration of Calicut was handled by the Bureau of the Air Force.

Alfred H. Hinkle, Jr., senior, retired Chief of Staff (ret.) of the United States Navy, was in line from the Navy's Royal Navy.

Dr. M. D. Doolittle, an associate director of the California Association of Engineers.

A. F. Hines, vice president, and J. L. Anderson, chief engineer, of Control Systems, Inc., at Imperial, Calif.

### Honors and Elections

W. A. Patterson, president of United Air Lines, elected chairman of Flight Safety Foundation's Industry Advisory Committee for 1955. Vice chairman, William L. Lusk, vice president of American Airlines.

Charles A. Ginter, vice president and chief engineer of A. V. Lee Company's Charles Ginter, Inc., resigned a member of the Hinkle Safety Group Design Council.

E. R. Hines, chief engineer of Douglas Aircraft Co., El Segundo Division, awarded the Paul V. Anderson Diploma by the Federation Aeronautique Internationale at its general conference in Paris.

### Changes

Robert F. Jones, executive assistant to the vice president-engineering, and Dr. R. D. Doolittle, chief of development, Temo Aircraft Corp. Dallas.

Vernon R. Doolittle, manager of the Industrial Association of General Aviation Associates, Long Beach, Calif.

D. C. Doolittle, controller of General Aviation Associates, Long Beach, Calif.

John D. Doolittle, controller of General Aviation Associates, Long Beach, Calif.

John D. Doolittle, controller of General Aviation Associates, Long Beach, Calif.

John D. Doolittle, controller of General Aviation Associates, Long Beach, Calif.

## INDUSTRY OBSERVER

► Republic F-105 supersonic fighter-bomber prototype is due at Edwards AFB only in July for initial flight testing several months ahead of schedule.

► Boeing will increase its B-52 production rate from 10 planes to 15 planes per month under the accelerated program previously ordered by USAF as a result of disclosure of Russian progress in long range jet bomber development (AW May 23, p. 11). Information on the new site comes from Avonair Mfg. Corp. which is the sole source for B-52 spoolers, titanium rollers, wheel well doors, bomb doors and radar cupolas.

► Northrop Airlines Super Constellation aircraft ditched 7 mi. out of Tokyo because lowering fuel pressure caused power loss in all four turbo compound engines. Plane had dropped to 1,500 ft. and pilot had gone "dead" in the cockpit when power gradually returned. Loss of engine control was determined to have occurred due to inverted fuel pressure. Results have resulted a service bulletin modifying the motor control to provide for emergency fuel supply in case of surge.

► North American F-108C is scheduled for delivery about July 1. The fighter-bomber by version of the Super Sabre is equipped for night intercept and has provisions for droppable external fuel tanks.

► Lockheed's Martin, Cal., Division is working in the field of nuclear-powered aircraft, according to R. R. Koster, assistant general manager of the division.

► Bristol Aeroplane Co. has announced plans to a seven thrust engine developed by Suez.

► Production strengthening and the learning curve has reduced the original \$40 per pound cost of the Northrop F-86-23 fighter interceptor to \$19 a pound.

► Initial costs for the Boeing B-52 is running about \$10 million per aircraft. Overall operating costs for a B-52 wing (30 bombers) is estimated at \$79, 200,000 annually.

► Convair's Ft. Worth, Tex., plant is converting a fleet of 36 C-54 four-engine piston into an engine aircraft. Larger fuel tanks, electronic devices for navigation and search and laser-type windows for better visibility will be installed. New designation is SC-54.

► Army has expended \$18,912,000 to date on its conversion program. Two prototypes have been built—the Bell XV-3 and the McDonnell XV-1.

► First Bombardier with Super Electron turboprop will start flight service with British European Airways in about a year. Plane is now at Super's Lyons factory being re-engineered and should make its first flight in a few weeks. Bombardier was built by Ampco Division of de Havilland.

► Rolls-Royce RB 109 turboprops are being installed in the second prototype of the Lockheed-Advanced Electrajet, expected to start flight tests late in 1956. Engines are rated at more than 4,400 hp. each for takeoff.

► An \$80 million research program and overhaul program is being used by the Canadian government to eliminate defects appearing outside the Toronto-Montreal area where Canada's aircraft industry is concentrated.

► RCAP Sabers in Europe equipped with the Gnome engine are outperforming USAF Sabers fitted with the GE J47-37 engine. RCAP ME V Sabers have higher climb rate and rate of climb than U. S. Sabers.

► Bell's method of blending, using superheated liquid steel jet, set in plywood support, is being reconsidered by Republic Aviation and North American Aviation production men for application to titanium alloy sheet, which has proved difficult to cut.



## Speed for Supremacy

The immediate challenge . . . facing business leaders in every field . . . is the urgent need for expansion and modernization to maintain facilities that will be large enough and strong enough for survival in the race for industrial supremacy.

Yesterday's facilities . . . yesterday's methods of operation are outmoded unless they are adapted to the challenge of today's business competition.

In the race to explore new markets with new products and new services, business faces a line of action

extending hundreds or thousands of miles from the home office. Division plans, distant developments, far-flung interests of every sort . . . all demand the attention of executives for on-the-spot decisions.

Beechcraft has helped thousands of expanding businesses meet the challenge of competition and of growth. Carrying at 800 miles per hour, with a cruise up to 1100 miles, the Beechcraft Twin-Bonanza flies faster and flies further than any other plane in the six-place class! Hundreds of business-owned Twin-Bonanzas prove—The World Is Small When You Fly A Beechcraft.



★ASK ABOUT  
BEECHCRAFT'S  
NEW EXCLUSIVE  
LEASING PLAN.

Perch Aircraft Corporation,  
Wichita, Kansas, U.S.A.

BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

## Washington Roundup

### \$83 Million for Airports?

There is a good chance Congress will pass legislation before adjourning providing \$65 million contract authority for federal aid for airport construction annually for the next four years—\$60 million for continental projects and \$5 million for territorial projects. If the President doesn't veto the measure, that would give Civil Aeronautics Administration authority to enter contracts for \$65 million an airport unit in fiscal 1956. The House and Senate have already approved a \$30 million appropriation for the year—almost double the Administration's request of \$11 million.

The Senate Commerce Committee has already approved the \$65 million authorization request, introduced by Sen. Mike Monroney (D-Gala), and Senate approval is expected this week. A companion measure has been introduced in the House by Rep. Owen Harris, chairman of the Commerce Transportation Subcommittee.

Under these measures, the Appropriations Committee would be obligated to appropriate funds "later" CAA had obtained contracts up to \$65 million annually. Under the 1946 Airport Act, CAA has had to obtain appropriations "before" it could make contracts.

### ATA Self-Enforcement

Some of the scheduled actions are delayed about the plan for setting up an enforcement office in the Air Traffic port Area, to police their own rules. The complaint is that they will be placed in "double jeopardy" because they are already subject to enforcement from the Civil Aeronautics Board's Office of Compliance.

However, ATA's board of directors approved "in principle" the adoption of an industry enforcement program to be put into effect Jan. 1, 1956. The Board approved the recommendations of the nation's Air Traffic Control cases that an enforcement action under a district he established within ATA. The subcommittee details and selection of a director, who will have cash fines as sanctions, will be worked out prior to the next ATA directors meeting in mid-December.

### New Aircraft Restrictions

Because of the rail and automobile publicity that follows an aircraft crash, NAA has again tightened its instructions on public dissemination of aircraft stall under development.

The new Bureau of Aeronautics instruction states that planes cannot be flown for other than experimental and developmental purposes until aircraft, its components and the pilot have 75 hours of flight time. Operating loads and components also must not exceed those established by the FAA.

### No Aircraft Show "Booms"

Air Force is expected to protest but Defense Department already has banned some shows and possible drops at 1955 National Aircraft Show. The new's Labor Day event at Philadelphia International Airport also will be held with reduced insurance coverage, following last year's major damage caused by Navy's discharge of atomic explosives. Residents near the Duxbury Airport who filed claims last June in Washington recently pre-

paring settlement and received support from Defense Department lawyers, who asked the show management to take action.

### Army Dissatisfaction

Further dissatisfaction of Army dissatisfaction with Air Force handling of its contract funds is a matter between Army and its contractors continue to coast to light.

Latest is disclosure that Navy was chosen to handle Army research and development funds allocated to a new proposed research plane. Proposals have been boiled down to three companies—Cessna, North American and Hiller—who are expected to get contracts for design studies. Aircraft will be small, for observation purposes.

Meanwhile, several Army witnesses told Senate Appropriations Subcommittee they place high hope in the Bell XV-3 and the McDonnell XV-1. Dark horse is McDonnell DC-1, a short-range, high lift helicopter powered by tip jets.

### New Washington Airport

Secretary of Commerce Sinclair Weeks is leaving it up to local residents in Maryland, Virginia, and the District of Columbia to take the initiative in construction of a new airport to ease the increasing traffic congestion at Washington National Airport.

"We have not as yet received any definite indication of active local interest," Weeks said in a letter to Chairman Warren Magnuson of the Senate Commerce Committee.

He added: "We still are pleased to work closely with the local governments in the development of an additional facility, if they indicate an interest and a willingness to participate in such development."

Local opposition killed off the original project to construct a new airport at Dulles, Va.

### Cargo Plane Leasing

Firming terms and conditions under which the Navy will lease medium cargo aircraft to commercial operators, and more particularly the monthly rental rate, is expected to further reduce the number of potential applicants.

Firm rules were first drafted following the Air Conditioning Committee's approval of the Navy program subject to numerous restrictions (AW June 13, P. 13). Two current rules intended in obtaining Navy equipment—how, then, eight DC-6's will be available—see Clark Aircraft and Flying Tiger Line but each has reported concerns that the price rates are too high. Clark, which had a three-month experimental lease at one point at a monthly rental of \$25,000, found its costs were increased more than 50% in meeting the Navy's requirement for a 3-600 hour contract.

Other potential lessees include American Airlines, United Air Lines and Seaboard & Western. All qualify under ACC's staff rules of eligibility. Interested carriers, however, will be asked to prove or disprove their application for cargo aircraft with Navy, which at one time had a total of 17 companies seeking more than 45 airplanes.

—Washington staff



enemy to fight a war, improve the economic foundation and control acts of sabotage.

Wiggins' attitude of the "war-hat" standard seems to help in an exchange of letters between him and J. R. Wiggins, managing editor of the Washington Post and Times Herald. Wiggins is chairman of the Board of Information Committee of the American Society of Newspaper Editors.

The editor challenged Wiggins' program to set up a new "pressures" plan that is unbalanced but which he thinks may help on Wiggins. Wiggins said that Secretary Wilson's order "has cast doubt upon all information . . . from the Defense Establishment."

#### Tests To Meet

In reply, the deputy assistant secretary denied the intention is to "limit the availability of information to that which is self-censoring." He said the public is urged to remain alert and needs there to "play their part as citizens."

He added: "There are, nevertheless, many cases where demands for information which take up the time of the public are schedules do not truly merit the acquisition of being useful or valuable, nor yet very interesting to the public. These are items that should be sent."

Wiggins came back with the observation that "no official inside the Defense Department is not likely to equal as constructive, information that disposes his own career. Persons on the outside of the Department may very well well discharge as a constructive and public service."

The editor also declared that the nature of a democracy requires a continuous flow of information from the representative to the represented, and that the citizens get "vicinity to the values of government."

Anything else, Wiggins said, "is an totalitarian philosophy in a free society."

#### Newman Complicates

In the past few weeks, growing concern over Administration efforts to strike the flow of news has resulted in a rising tide of complaints from Washington reporters. Vietnam newsmen on principle all both outside of Congress and the Supreme Court are complaining of the difficulty in getting news and the impossibility of publishing officials.

There also are instances of high-ranking personnel who are less than honest in answering queries. One Washington correspondent of many years experience says, "A Cabinet member has had to sit on two recent occasions

It never happened before. Sometimes, these men say no answers why they should not be to a newspaper."

Captain of House's "Defense" press committee to Army communication with a letter from Brig. Gen. F. S. Briggs, Deputy Chief of Information. He told the communication they were to serve as a guide in answering press and information queries.

An Army spokesman told Armstrong: "The sheets were sent out as an experiment to House's request 'to see how they would work in the field.'"

## Aircraft Industry Cuts Costs, Says Allen, Refuting Subsidy Charge

Seattle—U. S. aircraft industry is making "great strides" in reducing and controlling the cost of military plane production, William R. Allen, president of Boeing Airplane Co., said last week.

In Boeing plants alone, efforts to improve efficiency and cut expenses saved the government nearly \$100 million during the past several years, he told the Washington Star-Bulletin. Allen. The company's savings amounted to an additional profit to Boeing of less than \$10 million.

#### Profits, Competition

Allen stressed statements that the aircraft industry is making too much money and lacks competition. His answer to three charges included the following:

• **Average profits.** "In 1954 our (Boeing's) earnings represented 3.5% of sales. For a number of years prior to that, when the excess profits tax was in effect, our return was approximately 2% of sales. These figures are fairly representative of the aircraft industry. The companies with an average return of 5.7% on net sales for all manufacturing industry in the United States . . .

"In the early years of the new years since the end of World War II the aircraft industry made a return on net worth greater than that realized by all manufacturing industry, and the average for the aircraft industry for that time period is below the average for all manufacturing industry."

"The three years during which Boeing and the industry experienced a high return on net worth are 1952, 1953 and 1954, during which time the industry was working to a peak. Present military programming indicates the volume of business for the industry will now decline from this peak, with the result that the percentage of return on net worth will materially decline by as much as lower total profits applied to

It added that he did not think they were necessary, for experienced public information officers. "But we thought they might prove helpful to some of the first persons who came to the Navy's Pentagon public information officers refused to use the form, saying they could not judge such matters."

A Commerce Department spokesman said the "Business Council" was prepared "in consultation with general trade and business publications." Efforts to find a publisher or publishing group that was contacted were unsuccessful.

a higher net worth figure due to increased earnings."

• **Industry competition.** "I make the unqualified statement that the aircraft manufacturing industry is highly competitive. . . the B-52, for example, was designed and developed over a number of years. During that period it had strong competition—in fact, the project was close to death on a number of occasions."

"I assure you the B-52 has had a very competitive life and, as it has in the past, will in the future be challenged by the products of our competitors."

#### Subsidy Critics

Boeing's president also struck at subsidy critics who claim it is subsidized because the government furnishes land, plants and machinery for aircraft production.

He also stated the inability of aircraft companies to provide all facilities needed for production largely is due to these two factors:

• **Large fluctuations** brought on by even an insubstantial increase that require production to be moved around.

• **Industry expansion** on the rear line has not enabled it to provide such a necessary equipment and plants to meet these demands.

#### Pilot Blamed in Crash

Crash of an Alaska Coastal Airlines plane was probably the result of loss of control while the pilot was attempting to execute visual flight at less than required altitude and weather conditions, Civil Aeronautics Board reports.

The crash, occurred while the pilot was attempting a nighttime pass between Eads City and Hoonah in poor weather. The pilot died of injuries, and two passengers were seriously injured. The airplane, a Cessna 441-B, was destroyed.



WING SWEEP BACK AND HIGH MOUNTING are shown in the photo taken during XF8U-1 flight test of Edwards AFB.

## Supersonic XF8U-1 Details Revealed

Design features that fit Chance Vought's XF8U-1 for its role as a maneuverable fighter are its swept-back wing, high-mounted tail, and its high angle of attack.

The Navy asked for high rate of climb, extreme altitude capability and light weight. The aircraft was designed to meet these requirements. The swept-back wing, high-mounted tail, and its high angle of attack are the key features of the XF8U-1.

#### Aerodynamic Design

The high-mounted wing sweeps back approximately 40 degrees and has a small amount of sweep forward. This design allows the aircraft to maintain high speed at high altitudes. The swept-back wing is the key feature of the XF8U-1.

The aircraft's high angle of attack is another key feature. It allows the aircraft to maintain high speed at high altitudes. The swept-back wing is the key feature of the XF8U-1.

The aircraft's high angle of attack is another key feature. It allows the aircraft to maintain high speed at high altitudes. The swept-back wing is the key feature of the XF8U-1.

#### Powerplant Details

The aircraft's high angle of attack is another key feature. It allows the aircraft to maintain high speed at high altitudes. The swept-back wing is the key feature of the XF8U-1.

The aircraft's high angle of attack is another key feature. It allows the aircraft to maintain high speed at high altitudes. The swept-back wing is the key feature of the XF8U-1.

The aircraft's high angle of attack is another key feature. It allows the aircraft to maintain high speed at high altitudes. The swept-back wing is the key feature of the XF8U-1.

The aircraft's high angle of attack is another key feature. It allows the aircraft to maintain high speed at high altitudes. The swept-back wing is the key feature of the XF8U-1.

away for downward visibility over the nose in corner loadings.

Four engines—presumably the standard Navy arrangement of 20-inch engines mounted below and behind the pilot's floor—Cockpit layout and design follows current Navy practice. The quarter seat is the lightest-weight Chance Vought model (AFV, Apr. 18, p. 98), adapted from the original Douglas Aircraft Co. design.

Overall length of the XF8U-1 is about 58 ft., and height to the top of the vertical fin is about 18 ft. Maximum landing depth is about 10 ft., the wingtip clear the ground by six feet.

One major factor in the fighter's development was an extensive wind tunnel program, done by NACA, the Navy and the manufacturer. Wind tunnel tests of the first flight when the XF8U-1 went through the Mach one mark in level flight, is recorded in *Aerospace Week*, April 23, p. 96.

Flight tests have been made at Air Force Flight Test Center, Edwards AFB, under Vought test pilot John Kinnard.



EXTREME THINNESS OF WING and low setting of club tail show up in this view. XF8U-1 length is about 58 ft., overall height is 18 ft.



## Safety Emphasized

The first flying display occurred under the huge shadow of the ratee nose mounted in La Mure for previous weeks which killed 12 people and injured another 150 when a cargo air ploughed into the cockpit and exploded.

French public opinion too high about the La Mure tragedy and government officials seriously considered cancelling the flying display. The show went on with 53 helicopters, 150 jets, blood banks, rapid medical mobile recovery teams and thousands of police to control the crowd of 100,000 spectators.

First briefing was met with more safety precautions imposed on planned maneuvers. The pilots, particularly the French, were obviously having back to stay for within safety restrictions imposed during the display.

talks and on service aircraft such as the Venture.

An unaccounted by a Mistral-French developed Venture—and two dimensions, the dual-winged technique seemed very unusual. The planes rolled down on rough grass and dirt alongside the runway. The Hercules threatened to crash to stop at what appeared to be about 1,500 ft. They ran true and within 3 min. of touchdown, were using away on the hollow into which they had been headed and engaged by the quick-convert landing and release line.

Traffic identify leaving the letter on the ground and also carrying it left, were demonstrated to show that the aircraft was out of the area stage and a working proposition.

In light the plane demonstrated technical capabilities and the high performance air aspects of its configuration.

## Ambitious Aerobatics

Various tactics of Mistral were shown together with their old relative the straight-winged Venture. Four of the latter, mounting weapon tanks, comprise the simulate team of the French Air Force. In standards of themselves, this group added the USAF's previous F-86 mounted Skyblazers, although the French aircraft were not as modern.

An operational squadron of re-equipped T-28 Ventura powered Mistral Mack to proceed over. Coming into squadron service as Mistral's in the Service threat mission, located in the U.S. and Britain. This threat device was even recently re-equipped on a Mistral Mack 3, which after landing short proceeded to back up as a runway that slipped up behind the plane.

Another version of the Mistral, this time a black and two-seater night fighter, took off for Tiers 340 km away, carrying the French counter for overseas missions. This fighter looks much like an F-602 Sabre. It carries 30 mm cannons and rockets and is understood to have customer countries 3 to, on the 1,350 gal of fuel it carries internally.

## Strong NAA Influence

The North American Aviation has influence is strong in all the Dassault designs, making up the Super Mistral with its sloping nose and balanced nose tail. It also sports a thin tail plane mounted on the fuselage.

A 10,000-lb-thrust afterburning Avon turbojet is said to give it level appearance, although its dimensions at La Mure suggest a somewhat disappointing. It looked slower than the Phantom, which was being much lower and making a great deal of noise at a reported Mach .94.

The Super Mistral was said to be doing best 500 knots and carried more what after its rather feeble bang. The Mistral Mack 40 arrived ahead of its appearance bang.

All the Mistral series showed the benefits of good protection equipment. They took off and landed smoothly, climbed well and seemed quite steady in the air. Their rates of roll were universally good. Avionics control seemed precise and accurate.

## Fast-Climbing Ventours

Four all-weather and heavier two-engine Ventours took the air from their B-47 type tactical landing gear, getting off smoothly and climbing well. It was announced that the Venture reaches altitudes just under 40,000 ft in under 6 min., which can give the re-equipped something to think about. Some were fitted with Avon turbojets, others with Skyblazers—the latter giving out their leaving one rate familiar to those who have been near the Texas device.

The Venture is credited with 720-mph level speed but seemed slow to the eye. At 40,000 ft maximum weight, the Venture rolled fast for a plane of its size and gave very suitable carrying of its appearance to ground legs.

The fighter version carries a pair of 30 or 57-mm cannons, rockets and guided missiles. The hunter will carry several bombs. It was seen to have two low-level bombs and carried four bombs of what appeared to be 1,100-lb. each.

Using dividers, the landing distance was recorded.

## Convertible Jet-Fly

The Canardette brought the house down as France's first jet transport. It is to carry 70 to 90 passengers, with a

still air maximum range of 7,300 mi. This range is strictly suited for longer European and North African routes out of Paris.

In flight, the plane resembles the 170-seater Boeing 707, which makes sense it takes. Its great big oval nose makes it with a high jacked appearance.

With 28 engines and 15 lb. under its belt, it did not look as La Mure but demonstrated steep turns, high-speed and vertical speed flight most of its time.

It was the unbalanced Comet nose section and curved much of its fuselage in front of its main cabin wing area. Fuselage gave it much better and stronger spring is understood to be half that of Comet. Two 10,000-lb-thrust Avon turbojets on side wings from the rear fuselage give the Canardette an extremely clean forward appearance.

The flap seems to be of narrow chord and are large in span, extending right out of the side of the wing.

The transport handled well and should be ideal for French routes.

## Light Jet Brigade

Most intriguing was the performance of two Horni Dubois Model 32 high-speed jets with Dakota reduction in speed by Air France and the French Navy. They took off in some 1,500 ft or less and turned tightly within a small part of the Aerodrome area. Landings were as short as 1,000 ft.

Among the light brigade, the smallest was impressive—excluding the Sign, the Magister was the most of four and a Flettner that was checked about the do with giant size.

The smallest, full lightness, Flettner S-14 was significantly flown by Soder, who did a long spin down from the top of a vertical climb.

The Fast B-32 also flew well, doing extreme turns down from a vertical climb.

Quick response among the small unit was the 16 ft delta Pylon pushed by a single 350-lb thrust Turbofan. Pylon at over 300 mph in its pilot seat in the base of the Pylon. The Pylon is to be followed by a Viper or Twin Mustang version.

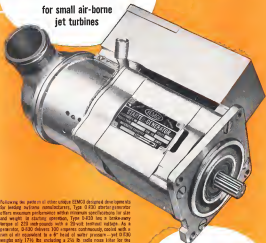
French pilots do not seem to employ much acrobatic in landing. The Pylon, which, it looked best, fit the approach. The turbine-powered Alouette was the most impressive of the numerous helicopters in service of carrying a small Citizen via round the aerodrome.

(This is the second of three special reports to Aviation Week on the 21st Paris Salon d'Aeronautique de W. William A. W. Norton, news Editor and pilot and an correspondent of the London Daily Express.)

# a New

## High-output, Light-weight STARTER-GENERATOR

for small air-borne  
jet turbines



Following the pattern of other unique EEMCO designed developments for leading turbine manufacturers, Type G-630 starter-generator offers maximum performance within minimum specifications for size and weight in starting operation. Type G-630 has a low-weight torque of 225 inch-pounds with a 28-volt terminal voltage. As a generator, G-630 delivers 1000 watts continuously, cooled with a fan of air equivalent to a 9" head of water pressure—yet G-630 weighs only 17½ lb., including a 250 lb. cubic inch liter for the starting operation.

The high output of EEMCO Type G-630 starter-generator is a result in its weight is typical of the many products designed, developed and produced by EEMCO for leading turbine manufacturers. Constant search for new materials and methods has resulted in production of highly efficient engines, motors and starter-generators that meet specifications for all their designs of supersonic aircraft and guided missiles.

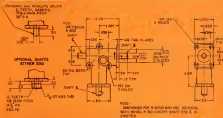
PRODUCT ENGINEERS are invited to review the specifications of these proven EEMCO products before making any design. Substantial savings in development time and cost can often be effected by adopting a tested EEMCO product with but minor changes to meet new conditions. Your inquiry is invited.

## Electrical Engineering and Manufacturing Corp.

4410 West Jefferson Boulevard  
Los Angeles 16, California  
Telephone RFD-3016, D-101

Designers and producers of reactors,

inner and rotary actuators



**GENERAL SPECIFICATIONS:**  
 1. AUTOMATIC FORWARD SPEEDS: 250, 500, 1000 RPM  
 2. GEAR RATIO: 11 OR 21  
 3. SHAPED TO ELIMINATE NEGATIVE INTERFERE DIRECTION OF ROTATION IS REVERSIBLE  
 4. DIMENSIONS FOR 9-3000 SERIES ARE IDENTICAL WITH 9-3000  
 5. WEIGHT: 100 LBS.  
 6. SHAFT: 1/2" DIA. X 1.5" LONG



## HOW TO MAKE A RIGHT-ANGLE BEVEL GEAR

Need a right-angle gear drive? You can make one yourself. Here's all you need: a set of Coniflex® gears, a precision-cast housing, antifriction bearings, and shaft extensions. Put these together, lubricate the unit for life, test it for quietness (noise means future trouble), and you have a right-angle drive. Too expensive, you say? That's why we would urge you to buy ANGLEgear, a compact, standardized take-off that has won the respect of designers everywhere.

\*Trademark The Glass Works, Rochester, N.Y.

Ratio	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output
Ratio	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output
1:1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
2:1	2.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
3:1	3.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
4:1	4.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
5:1	5.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
6:1	6.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
7:1	7.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
8:1	8.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
9:1	9.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
10:1	10.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
11:1	11.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
12:1	12.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
13:1	13.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
14:1	14.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
15:1	15.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
16:1	16.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
17:1	17.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
18:1	18.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
19:1	19.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
20:1	20.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

LINEAR • ROTARY • TRIM TOOL • ROTORFETTER • ANGLEGEAR • ROTOLON

**AIRBORNE**  
 ACCESSORIES CORPORATION  
 HILLSIDE 6, NEW JERSEY



**NEW AIRBORNE CATALOG**  
 Send us for information on the Airborne line of electronic and mechanical products. We'll give you the new catalog today.



## XC-99 Starts Record 300,000-Lb. Airlift

Covers XC-99 takes off from Kelly AFB at San Antonio en route to Dover, Del., where it will start a record 300,000-lb. cargo load to Iceland. It is the largest task assigned to a single U.S. aircraft.

The giant Air Force transport is expected to move the entire 150 tons of cargo in five loadings, each scheduled at 34 hr. KC-99 will arrive at Goose Bay during the Dover-Keflavik shift.

## Avionic Industry's Job Outlined

U.S. Air Force's contracting to build an avionics equipment means that the electronics industry must increase production while maintaining essential quality standards. Lt. Gen. Clarence S. Irvine, USAF Deputy Chief of Staff for Materiel has made clear.

In accepting greater responsibility, Gen. Irvine is emphasizing better a Radio Electronics Technician. Man-Electronics Assoc. meeting in Chicago that USAF does not intend to let prime contractors, usually aerospace makers, branch out into avionic fields if it can be avoided.

Pointing out that today's interceptors may carry more than 2,000 lb. of avionics equipment, compared with 1,500 lb. ten years ago, Gen. Irvine said electronics complexity is one of the important reasons why USAF had to turn to the weapons system contractor for procurement.

Introduction of the missile intercepter, he said, was a step taken to make sure that USAF capabilities on the stability of the most prominent segments of industry. The aerospace contractor, given performance specifications by the prime contractor, is free to establish his own detailed design of the item.

The materiel officer, Irvine's special deputy commander of the Air Materiel Command at Dayton, also made these points in reply to avionic industry critics.

• The prime contractor is responsible for overall design and development of the weapon system, but the aerospace contractor shares this job for his component. It is not USAF's intent to "encourage an in-house industry to

take over the development and production of parts or sub-systems from the established contractors which already provide such component."

• To control those procedures, USAF delineates which items are to be made by the aerospace contractor, in turn in a substantial spread of subcontracting, permits deviations only with written approval and requires that prime contractors implement their own program.

• USAF will not provide facilities, except as a last resort and will finance them only when it is convinced there is no other qualified source of supply or economy.

• Broad industrial base and geographic dispersion of sources must be maintained.

• Greater standardization is a constant goal but not when enforcement will at any time limit capability of the weapons.

## Cambridge Center Gets New Home

Air Force Cambridge Research Center, home of Project Lincoln and other scientific projects in operations, electronics and geophysics, is moving its headquarters and most of its personnel to new quarters at Lawrence G. Hanscom Field, Bedford, Mass.

Office at the 6125th Support Wing (Civil) will remain with the center and become 6120th Air Base Group under the command of Col. Stanley W. Fitz-Gerald, Jr.

The main portion of the building program at the field is expected to be completed next year.

## Warning System Costs

Details of USAF's plan for Fiscal 1966 Aircraft Control and Warning System construction to military units. Prior to the test, however, is not classified. The figure, for work on the United States and abroad \$21 million.

Some 50% of the program is for expansion of the electronic command and control system, control link between the warning net and the weapon system.

Also on the schedule are facilities at existing permanent and mobile radar sites and construction of 74 new "pop-up" sites.

Work will be continued on the DEW line across North America and at other overseas sites, including Alaska and Canada.

## Armstrong Whitworth Opens New Tunnel

A Mach 1 wind tunnel for studies of thermal effects on high-speed aircraft has been opened by the W. G. Armstrong Whitworth Aircraft Ltd. at its Wharfedale aircraft plant.

Working some of the new tunnel is from Mach 0.5 to 3.0. Nozzle blades are used to vary the Mach number; their use was determined by standardizing a test model for supersonic Mach numbers.

Airframe data recording and time passing equipment has been developed and installed in the tunnel test house. This is the first equipment tested for AWA, and it will supplement an older automatic image tunnel. The new unit was developed with company funds.

## CAB Stands Pat in Pacific Case

The Civil Aeronautics Board has rejected requests of Pan American World Airways, Transoceanic Air Lines, and Trans World Airlines for removal of the CAB's decision in the trans-Pacific certificate renewal case (AW Feb. 18, p. 12).

Reconsideration petitions of the three carriers were refused by 3 votes of a Board subcommittee. The vote was 2 to 1 on the motions and they failed for want of a majority. CAB Chairman Ross Butler did not participate because he did not take part in the original decision.

Vice Chairman Joseph Adams and Member Jack Lee upheld their previous position in supporting the application of TWA and TWA and would have granted the petitions. Members Gurney and Deany voted for denial. Transoceanic claims that the Board committed a prejudicial error in the first case was advanced by both Gurney and Deany.

The original decision denied Transoceanic's application on the grounds that it already possesses sufficient air in regular routes to conduct the scheme.



"CLIP-TYPE" closed entry socket contact now standard in

## BENDIX-SCINFLEX ELECTRICAL CONNECTORS



Causes no overcurrent—eliminates intermittent circuit problems resulting from socket contact insufficiency

The heart of any electrical connector is the socket contact. This is why the Bendix-Scinflex socket contacts have always been insulated from the circuit. Soakage, with their required dielectric action, can be easily reversed.

Even with the most robust sockets, industry has been plagued with corrosion, spring failure due principally to the misuse of test probes and live testers on pin contacts. Bendix engineers have now provided the only socket contact on the market today which

completely eliminates all three problems.

The "Clip-Type" socket will not accept any excessive probe or pin, nor can it be forced into it. Also, no amount of scratching or twisting of an acceptable pin or probe can possibly distort the spring clip. This new socket is now standard in all Bendix connectors including those using solderless, high-compressive and thermomagnetic contacts.

One who depends will be glad to furnish complete information on request.

Circle 10

SCINTILLA DIVISION of  
SPERRY, NEW YORK



Sperry Sales and Technical Division, 355 E. 42nd St., New York 17, N. Y.

SALES OFFICES: BOSTON: 100 State St., Boston 10, Mass. (617) 552-1100; CHICAGO: 100 W. Madison St., Chicago 10, Ill. (312) 552-1100; CLEVELAND: 100 W. Broad St., Cleveland 10, Ohio (216) 552-1100; DALLAS: 100 W. Main St., Dallas 10, Texas (214) 552-1100; DENVER: 100 W. Main St., Denver 10, Colo. (303) 552-1100; LOS ANGELES: 100 W. Main St., Los Angeles 10, Calif. (213) 552-1100; MIAMI: 100 W. Main St., Miami 10, Fla. (305) 552-1100; NEW YORK: 100 W. Main St., New York 10, N. Y. (212) 552-1100; PHOENIX: 100 W. Main St., Phoenix 10, Ariz. (602) 552-1100; SAN FRANCISCO: 100 W. Main St., San Francisco 10, Calif. (415) 552-1100; SEATTLE: 100 W. Main St., Seattle 10, Wash. (206) 552-1100; SALT LAKE CITY: 100 W. Main St., Salt Lake City 10, Utah (801) 552-1100; TAMPA: 100 W. Main St., Tampa 10, Fla. (813) 552-1100; WASHINGTON: 100 W. Main St., Washington 10, D. C. (202) 552-1100.

stream." The authority of an engine he cannot do so without an international license sought by Transoceanic. They said, however, "This does not in our judgment justify a change in the present decision." Adams, disagreed. He said, "The case should have been called to the President's attention since he may have ruled upon that case in denying Transoceanic's application."

The two voting Republican members also favored denial. TWA's petition Gurney and Deany said that "while the motion presented by TWA strengthens its position they are not sufficient to reverse the other considerations that dictate denial of its application." TWA particularly made a point of its subsidiary operations and the subsidy situation at both the Atlantic and Pacific which has materially improved.

Direct action between the West Coast and Europe has been proposed by Trans World Airlines, subject to Civil Aeronautics Board approval.

TWA wants Los Angeles, San Francisco, Oakland, Portland and Seattle in its terminals and TWA international routes. If the application is granted, TWA would be permitted to use the shortest, most direct route from any of the five Pacific Coast cities to London and Paris.

TWA officials pointed out that they might fix the "pole route," but want to be free to choose the most advantageous route with the new Lockheed Super G Constellation. The U. S. carrier now operates one place international routes from Chicago and Detroit as well as New York, Philadelphia and Boston which is supplemented by domestic international service.

## UAL Favors Jets

United Air Lines probably will order long range jet transports in its next large purchase of new aircraft. UAL will ask for delivery in 1959 or 1960.

"Our best preference for engine delivery would be the turbofan jet, short-haul operations, to be followed by delivery of jet aircraft for longer haul operations," said United President W. A. Patterson last week.

"However, our expansion rate has not yet reached that there is a power engine for the turbofan, whereas we have in this country today the greatest jet engine in the world in the (Ford & Whittle) J57."

Under these circumstances, the jet may come first.

"It is difficult to evaluate the Lockheed Electra (AW June 18, p. 12) with our detailed specification, which they advise us will not be completed for several months."

## "How much will my heat exchanger weigh?"

WE HAD THE ANSWER IN ONE HOUR

2 POUNDS!

This is the kind of service which we like to give to the engineers in the aircraft industry. UAP's 26 years experience in furnishing high precision components enables us to accurately furnish fast, accurate information to design groups far in advance of the actual need for the components. Let us quote weight and displacement figures in the pre-design planning of your developments.

CALL { RAYMOND MATHIAS 1941  
New York 17, New York 17, New York 17, New York 17  
Los Angeles 17, New York 17, New York 17, New York 17  
New York 17, New York 17, New York 17, New York 17



UNITED AIRCRAFT PRODUCTS, INC.  
1116 BOLANDER AVENUE, DAYTON, OHIO



## "EXECUTIVE STOP" for Washington D.C.

**Easton Municipal Airport  
Offers Complete Facilities  
for the Executive Aircraft  
Operator Who Travels to  
Washington, D. C.**

SHOP AT THE EASTON MUNICIPAL AIRPORT IN MARYLAND

Put down an entire one of the two 4050 ft. paved runways. Receive complete Cities Service Aircraft Servicing—the finest in the world. Enjoy a leisurely ride into Easton in comfortable Cities Service station wagons. Spend a useful and enjoyable evening in the Tide-water Inn, Easton's ultra-modern, size hundred and twenty-room hotel. Arise refreshed the next morning and make your twenty-minute hop into Washington.

Easton's 350-acre Maryland Airport is the perfect answer for the busy flying executive who does business in Washington, D. C. Why not stop over next time you're seen by?



Easton—A Regular Stop for Allegany Airlines. Direct Service to New York and Washington.



Private Plane Operations—Buy flying gear, accessories. And Easton has the perfect place when you need to Web again, D. C.



Need Complete Servicing Facilities—Repair aircraft and engine maintenance by General Aviation Service Incorporated. General & Building, Area Commercial Industries.

**CITIES SERVICE**  
  
**AVIATION PRODUCTS**

New York • Chicago • In the States: Continental Fuel Oil Corp.

## New Military Aircraft Order Lag Continues

New orders for aircraft and related procurement continued to lag through April, and Air Force and Navy had an unobligated balance of \$3 billion on hand May 1—just two months before the close of Fiscal 1955.

Of the total unobligated fiscal USAF had \$3.7 billion and Navy \$1.4 billion.

Navy had net obligations of only \$79 million during April. USAF's net total was only \$215 million.

Heavy Appropriations Committee a few weeks ago reduced by \$150 million USAF's fiscal 1955 funds for aircraft and related procurement because the

services of Fiscal 1955 funds would be greater than anticipated. The committee said the carryover would be \$2.9 billion. But the outlook is that it will be even larger than this.

To reduce its May 1 unobligated balance of \$3.7 billion to \$2.9 billion by July 1, the Air Force would have to obligate \$1.4 billion monthly during May and June. USAF's average monthly obligation for the first 10 months of the year was \$168 million. Navy's obligation for the first 10 months of Fiscal 1955 totaled \$735 million, an average \$73.5 million monthly.

The unexpended balance for aircraft and related procurement on May 1 was \$18.8 billion. This was divided USAF, \$13 billion; Navy \$5.8 billion.

## Banshee Landing Seen From a Banshee . .



These photos of a McDonnell Banshee rising in for a landing on the USS Oriskany at about 120 knots were taken from an F4H SP photo Banshee reconnaissance off the coast of California. The photo ship has a K-48 forward-looking aerial mapping and reconnaissance in its nose.

**STANDARD  
PARTS  
AND EQUIPMENT CORP.**

*Your Fast,  
Dependable*

**SOURCE OF SUPPLY  
ON CONNECTORS  
AND ADAPTERS**

We manufacture these connectors and adapters in a complete range of sizes.



The connectors and adapters pictured above are manufactured in our factory in right government specifications, immediately available for fast delivery to fill your orders of any size.

Now—by your order from Standard Parts, where excellent facilities and experienced representatives are ready to handle your emergency problems. For prices and delivery information, call, write or wire to the address below.

Write us your company letterhead for pricing listing the Standard of 400 parts in stock.

**STANDARD  
PARTS  
AND EQUIPMENT CORP.**

Telephone: TRAM 4458 • TWX BT 8710  
P.O. Box 4306 • Fort Worth, Texas  
OFFICES  
365 E. 44th Street • Longwood, Calif.  
3916 East 136th • Wilmette, Illinois



## IT COSTS LESS TO FLY WITH CONTINENTAL POWER

Continental's continuing interest in its product, after the sale, makes a big difference in the cost of plane ownership and use. Continental aircraft engines are not only built to exceed their full share of pushback, but backed with the kind of service that keeps them running year after year. When major overhaul time rolls round, the owner can replace his engine with a factory-remanufactured power plant—back in two years, and with factory new engine guarantees—at very low fixed cost and with virtually no down time. Continental's Factory Remanufacturing Plan is one more in a long list of reasons underlying pilot preference for planes with Continental power.

\*\*\*

PARTNERS IN MAKING PRIVATE FLYING  
THE SAFEST MEANS OF TRAVEL



**Continental Motors Corporation**  
Aircraft Engine Division  
MUSKOGEE, MICHIGAN

### Navy Contracts

Contracts recently announced by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11, are:

**North American Aviation, Inc., Garden City, 4400 E. 70th St., Cincinnati 29 Ohio:** maintenance parts for 42 J44-101, \$228,475.  
**Raytheon, Incorporated, Wey, England:** 100 J44-101.  
**Amelco, Inc., Northridge 15, Los Angeles 44, California:** parts, \$18,000.  
**American Piston and Valve Co., Northampton 40, Greenfield, Ohio:** pistons, \$110,417.  
**Roll Aircraft Corp., P.O. Box 487, Fort Worth 1, Texas:** maintenance parts for J44-101, \$10,070.  
**General Electric Co., 410 South St., New York 1, New York:** 1,000 J44-101.  
**Harley Compton Co., Minneapolis 10, Minneapolis, Minn.:** 10,000 J44-101, \$23,500.  
**Meridian Engineering, Inc., Dayton Road, Dayton 10, Ohio:** 10 J44-101, \$10,117.  
**New Aero, Incorporated, 200 N. Duquesne Ave., Pittsburgh 4, Pa.:** 1,000 J44-101.  
**North American Aviation, Inc., Cincinnati 29, 4400 E. 70th St., Cincinnati 29 Ohio:** maintenance parts, \$98,400.  
**Engel Air Mail, 11000, Springfield Ave., Chicago 14, Ill.:** 1,000 J44-101.  
**Raytheon, Incorporated, Wey, England:** 100 J44-101.  
**General Electric Co., 410 South St., New York 1, New York:** 1,000 J44-101.  
**Harley Compton Co., Minneapolis 10, Minneapolis, Minn.:** 10,000 J44-101, \$23,500.  
**Meridian Engineering, Inc., Dayton Road, Dayton 10, Ohio:** 10 J44-101, \$10,117.

### BuAer Contracts

The following contract awards of \$25,000 and more have been announced recently by the Bureau of Aeronautics, Department of the Navy, Washington 25, D. C.:

**North American Aviation, Inc., Garden City, 4400 E. 70th St., Cincinnati 29 Ohio:** maintenance parts for 42 J44-101, \$228,475.  
**Raytheon, Incorporated, Wey, England:** 100 J44-101.  
**Amelco, Inc., Northridge 15, Los Angeles 44, California:** parts, \$18,000.  
**American Piston and Valve Co., Northampton 40, Greenfield, Ohio:** pistons, \$110,417.  
**Roll Aircraft Corp., P.O. Box 487, Fort Worth 1, Texas:** maintenance parts for J44-101, \$10,070.  
**General Electric Co., 410 South St., New York 1, New York:** 1,000 J44-101.  
**Harley Compton Co., Minneapolis 10, Minneapolis, Minn.:** 10,000 J44-101, \$23,500.  
**Meridian Engineering, Inc., Dayton Road, Dayton 10, Ohio:** 10 J44-101, \$10,117.  
**New Aero, Incorporated, 200 N. Duquesne Ave., Pittsburgh 4, Pa.:** 1,000 J44-101.  
**North American Aviation, Inc., Cincinnati 29, 4400 E. 70th St., Cincinnati 29 Ohio:** maintenance parts, \$98,400.  
**Engel Air Mail, 11000, Springfield Ave., Chicago 14, Ill.:** 1,000 J44-101.  
**Raytheon, Incorporated, Wey, England:** 100 J44-101.  
**General Electric Co., 410 South St., New York 1, New York:** 1,000 J44-101.  
**Harley Compton Co., Minneapolis 10, Minneapolis, Minn.:** 10,000 J44-101, \$23,500.  
**Meridian Engineering, Inc., Dayton Road, Dayton 10, Ohio:** 10 J44-101, \$10,117.



"Pushing Today's  
Tomorrow's Aircraft Requirements"

Engineering and design development to  
Master Engineering Associates  
Glendale, California

Master Engineering Associates  
Glendale, California

Master Engineering Associates  
Glendale, California



Lead is a new source for landing gear and components on the West Coast. Versatile equipment and facilities have enabled Lead to produce shock struts, shimmy dampers, steering units, drag brace assemblies, down locks, landing gear transmissions and actuating cylinders... a complete package for the aircraft industry.

Lead has experience in newer designs employing high heat treats of 280-290,000 psi and new materials such as Hy-Tef and Titanium, which are now required in producing modern landing gear and components.

**H. W. LOUD MACHINE WORKS, INC.**

907 EAST SECOND STREET, DEPT. 10 • POMONA, CALIFORNIA

# AERONAUTICAL ENGINEERING

## Gas Turbine Improves Performance

By J. J. Samoil

The introduction of the helicopter, noted for its low speed flight characteristics, appears to be an incongruous note in the transport race.

A second glance reveals that the helicopter, like the jet transport, is being introduced to keep up with modern rapidly increasing living pace. The ability of the helicopter to operate into downtown metropolitan areas eliminates the noise barrier becoming part of an urban trip of less than 200 or 300 mi., the time taken to and from the airport. Using the rotor shaft as a significant decrease in total time.

The helicopter will bring the speed and convenience of air transportation to a point many smaller craft that have not been able to economically justify an airport but could maintain helicopter facilities. This means a considerable increase in speed over the ground transportation now serving these areas.

Speed itself is not a completely reliable commodity. The success of the helicopter as a commercial transport vehicle will depend on how well it can increase up to operating hours of transportation in terms of safety, cost, fuel, convenience and economy as well as how much it can decrease travel time. Helicopters in commercial passenger service today are proving that there is a definite need for the type of service they can provide, even though they have something to be desired in respect to some of these other factors. But, before the helicopter can hope to achieve widespread acceptance, for commercial transport use, significant improvements will have to be made. One such improvement could be the gas turbine engine.

It won't until the known conflict had passed the utility and value of the

helicopter that the government agreed to divert a part of the gas turbine industry's activities to build smaller size, shift power engines in order to adapt this powerplant to helicopters. Just as the jet engine has revolutionized combat aircraft, the gas turbine engine could increase many of the shortcomings of conventional gas powered helicopters.

### Copter Competition

By taking advantage of the experience of large jet engine developers, it is now possible to design and build gas turbine engines with specific fuel consumption comparable to reciprocating engines of the higher power required for helicopter operation, and with specific weights less than one third of that of reciprocating engines. This efficiency and light weight, combined with the simplicity, reliability, and flexible speed-power relationship of the gas turbine engine can make significant improvements in all four of the factors on which the success or failure of the commercial transport hinges: Speed, safety, comfort, and economy.

In order to feel out just how significant these improvements can be, let's consider two hypothetical transport helicopters with a gross weight of 17,000 lb. One of these could be powered by two 1,500 hp gas turbine engines (see hypothetical chart) which would provide sufficient power to maintain flight with one engine out, even at a gross weight of 17,000 lb. One of these could be powered by two 1,000 hp gas turbine engines (see hypothetical chart) which would provide sufficient power to maintain flight with one engine out, even at a gross weight of 17,000 lb. One of these could be powered by two 1,000 hp gas turbine engines (see hypothetical chart) which would provide sufficient power to maintain flight with one engine out, even at a gross weight of 17,000 lb.

As does the power of the gas turbine, the weight of the helicopter can be compared with two 1,000 hp gas turbine engines to meet the same critical performance conditions. Hypothetical compound engines will be used for the latter helicopter, representing the latest known state-of-the-art for reciprocating powerplants. The two helicopter differ-

ences will be essentially the same.

The maximum flight speed for a helicopter is generally limited by retreating blade stall which is a function of rotor tip speed. The higher the tip speed, the faster the helicopter can fly before encountering blade stall. In contrast, it is desirable to operate at a relatively low rotor speed in order to obtain maximum lift and low engine performance. With a reciprocating engine, horsepower output is directly related to the speed, with the high power needed for takeoff obtainable only at a high engine speed. At the lower cruise power setting, the engine should operate at a lower speed to obtain highest efficiency and longest life. This results in that the helicopter rotor is usually operated at nearly a constant speed as a compromise between the high engine speed and low rotor speed desired for lift and the low engine speed and high rotor speed desired for cruising.

### Speed Increase

In the two engine version, the turbine that produces the output shaft power is not mechanically connected to the compressor and compressor-driven turbine. Its output power is much independent of output speed over a fairly wide range (Fig. 1) so that sufficient power can be taken from the rotor characteristics. Fig. 2 shows the rotor power required vs. flight speed for the two helicopters. The rotor of the turbine-powered helicopter can operate with a top speed of 540 mph for lift and hovering and at 560 mph for cruising at 600 ft/sec with the reciprocating engine. With the 40% increase in rotor speed, the maximum flight speed can be increased from 140 mph to around 170 mph.

Increasing power is required with speed for the two engine version. At the low speed, the turbine engine, higher power units having specific fuel consumption. As a result, the

two engine version is capable of maintaining level flight on one engine at the cost of a failure of the other engine. But what would happen in the event of an engine failure as a hot day during takeoff from a very congested area where the pilot had not given sufficient altitude or forward speed to permit him to fly out on one engine? It then becomes necessary to

FIG. 4



the most economical cruising speed occur at about 150 mph (Fig. 3), which is well below the maximum speed. For the turbine engine, specific fuel consumption decreases with the higher power and hence the most economical cruise occurs at top speed.

### Safety Considerations

In addition, the turbine engine is designed to operate continuously at its lower power rating without detrimental effects to its operating life. Its power has shown that operation of reciprocating engines for extended periods at high or near normal rated power results in decreased service life. Thus, in commercial transport operation, the helicopter powered with the reciprocating engine probably would not be operated much over 415 mph, while its turbine-powered counterpart can be operated at more than 150 mph.

This means a possible reduction of on route time of more than 30%, significant for a vehicle whose existence can only be justified by its ability to save time.

Speed is only important as long as it can be achieved safely.

The helicopter in commercial service today has achieved an outstanding record in safety in operation. Progress into more complex helicopter versions, the turbine engine can make some definite contributions to safety.

The small size and high power to weight ratio of gas turbine engines make it possible to install additional power to provide for an additional engine.

There is 1,500 hp installed in one engine powered by the turbine engine for less than half the weight and volume required to install 2,000 hp in the other with reciprocating engines (Fig. 4). This gives the pilot an extra 340 hp, an overall gain.

Both of these helicopters are capable of maintaining level flight on one engine at the cost of a failure of the other engine. But what would happen in the event of an engine failure as a hot day during takeoff from a very congested area where the pilot had not given sufficient altitude or forward speed to permit him to fly out on one engine? It then becomes necessary to

FIG. 5



be able to lower with one engine not long enough to land. With reciprocating engine power it would either require the installation of a third engine or installing two larger engines to prepare for such an emergency should it prove necessary. This would be almost prohibitive from the performance standpoint.

A third gas turbine engine could be added to the other helicopter and it would still have an engine weight advantage over the original two-engine reciprocating installation.

But the characteristics of the gas turbine make the third engine unnecessary. When extra power is required in short periods of time the turbine can be operated above normal temperatures for the few seconds required to land the helicopter. The engine would have to be pulled for inspection and possible overhaul after such an emergency, but there would be no loss in life or damage to the helicopter.

### Engine and Noise

What fatigue is another important factor in aircraft safety. The helicopter is particularly bad at this respect because of the high degree of pilot concentration required to fly it.

When extra gas turbine engines are added, some improvement over the reciprocating type. The control of the gas turbine is completely automatic, and will provide constant power for all control operations, maintaining the rotor speed constant at a value preset by the pilot. It is unnecessary for the pilot to touch the engine control at any time during normal flight conditions, with reciprocating engines he must adjust the engine throttle to maintain desired rotor speed.

What fatigue is also directly affected by control vibration and noise level.

Most all adverse comments received by the pioneering transport helicopter operators have concerned low altitude. The most annoying comments stem from the excess noise and vibration in the passenger compartment. Both of these conditions can be improved by the gas turbine engine.

The reciprocating engine which decreases its power from intermediate drag of the cylinder, contributes to the objectionable vibration noticeable in the cockpit and passenger compartment. It has been necessary to include a flywheel in reciprocating engine installations to partially smooth out these impulses, but a flywheel is extremely critical and it would be impossible to install a flywheel large enough to completely damp these out.

FIG. 6



The gas turbine engine drives its power from continuous burning of fuel in the combustion chamber and a continuous flow of air through the turbine wheel. There are no power pistons. What little vibration is induced by the engine will be all low magnitude and high frequency, which is easily isolated.

This gas turbine engine differs from the helicopter in that an additional turbine wheel is introduced into the path of the exhaust gases to reduce the velocity, then then in the form of shaft power. As a result this turbine wheel serves as an effective silencer. Tests run on two separate experimental gas turbine installations have indicated that the noise level is at least 10 decibels lower than with reciprocating engines in the same machine. In addition, the noise from the gas turbine is of high frequency and can easily be eliminated from the cockpit and passenger compartment with lightweight soundproof material.

### Turbine Economy

The fuel economy of a turbine or not the helicopter will succeed as a commercial transport has in its economy. The gas turbine engine can make its most important contribution in providing reserve and increasing operating range.

The low specific weight of the gas turbine engine is its most significant characteristic because every pound reduction in the empty weight of a transport helicopter means another pound of payload it can carry and hence, more economy. Fig. 5 shows a comparison of the payload which the two 17,000 lb helicopters can carry for various engine thrust ratings. The turbine engine-powered helicopter could carry 25 passengers while the reciprocating engine-powered helicopter could carry only 16 (Fig. 6). Then, for the same trip, using the same gas turbine, the

The author is a member of the Board Air Staff, Defense Division, General Electric Co., Hartford, Conn.

FIG. 1



FIG. 2



FIG. 3









# VICKERS "Instant Response" HYDRAULIC MOTOR

## ... THE AIRCRAFT HANDY MAN



Vickers Constant Displacement Off-line Type Hydraulic Motors are available in 35 sizes for 3000 psi.

Here Are a Few of the Jobs It Is Doing:

<p><b>AIRRAIL REFUELING PUMP DRIVE</b></p>  <p>Fast Transfer Pump built by West Engineering Co. for Boeing KC-10 Tanker. Powered by Vickers "Instant Response" Hydraulic Motor.</p>	<p><b>CABIN SUPERCHARGING</b></p>  <p>Boeing DC-7 Cabin Supercharger is driven by Vickers "Instant Response" Hydraulic Motor.</p>	<p><b>HORIZONTAL STABILIZER ACTUATOR</b></p>  <p>Built for Grumman F16 by Cleveland Pneumatic Tool Co. Powered by Vickers "Instant Response" Hydraulic Motor.</p>
<p><b>ALTERNATOR GENERATOR DRIVE</b></p>  <p>Alternator Generator Drive for Cessna 172 on Vickers "Instant Response" Hydraulic Motor.</p>	<p><b>TELESCOPING BOOM ACTUATOR</b></p>  <p>Built by Jack &amp; Sons for aerial bucket. Powered by Vickers "Instant Response" Hydraulic Motor.</p>	<p><b>AIR COMPRESSOR DRIVE</b></p>  <p>Built by Walter Kille &amp; Company, Inc. and driven by Vickers "Instant Response" Hydraulic Motor.</p>

## What Can It Do for You?

**VICKERS Incorporated**

DIVISION OF THE LINCOLN CORPORATION

10401 DASHMAN BLVD. • DETROIT 26, MICHIGAN

Application Engineering and Service Offices:

16000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

10000 E. 14th Ave., Detroit 4, Mich. • 10000 E. 14th Ave., Detroit 4, Mich.

\*"Instant Response" means it starts, stops or reverses almost instantly.

FIG. 7 (Inch-lbs. and miles x 100)



FIG. 8



FIG. 9



gas turbine can increase the payload by nearly 40%.

But that doesn't tell the complete story. While payload is proportional to the number of horsepower (or power-governed) air-powered, operating costs are a function of the number of hours of utilization. A more realistic figure of merit to use for the comparison of the two helicopters would be the ratio of cost to cost, or power-per-mile per hour.

The turbine-powered helicopter requires only 1.4 hours to complete the 250 mi. trip at 150 mph, while 1.4 hours are required for the reciprocating engine-powered vehicle flying at 115 mph. The figure of merit for the former would be 3,516 mi.-miles/hr. as compared with 1,590, which represents an increase of about 77% (Fig. 7).

### Cost Comparisons

The direct operating costs, at a dollar per hour basis, will be slightly higher with gas turbine engines (\$211/hr. vs. \$144/hr.). But because of the higher figure of merit, direct operating cost in cents per system can be reduced by nearly 45% with gas turbine engines (Fig. 8).

If a reciprocating engine-powered helicopter were designed for the same

capacity (25 passengers) as the 37,000 lb. turbine-powered helicopter, it would require a gross weight of about 22,000 lb. The direct operating costs for this helicopter would be around \$134 per hour, which would result in the costs per system shown on Fig. 9. While these costs are a little lower than those of the 15 passenger helicopter, they are still almost 40% higher than those for the 25-passenger turbine-powered helicopter.

Even though the gas turbine will increase more fuel than the reciprocating engine (24% gal. as compared with 21% gal. for a 200 mi. trip), the cost of 10-15 gal. for the turbine engine

is about 15 cents per gallon while aviation gasoline costs about 30 cents per gallon. The total fuel cost for the 200 mi. trip, therefore, would be reduced from \$134.78 down to \$41.78 by using the turbine engine. This represents a reduction of about 33% in fuel costs for the 25-passenger helicopter.

### Purchase and Maintenance

Initially, gas turbine engines may cost more than reciprocating engines. This difference has been taken into account in the above operating cost comparison. As time goes on the cost of the gas turbine should decrease, and eventually the cost is dollars per hour.

## Cole Electric Co.

AIR HYDRAULIC DRIVE • CHERRY CITY, CALIFORNIA • TERRY HART



Interometer Rocket Firing S.M.S. Interometer Hermetically Sealed

### STRAINING, EMBELLISHING AND PRODUCTION FOR THE AIRCRAFT INDUSTRY

- Strainers
- Embellishers
- Interometers
- Frequency Meters
- Power Relays
- Transformers
- Rectifiers
- Rectifier Relays
- Rectifier Inductors
- Rectifier Relays
- Air Circuit Breakers
- Circuit Breakers
- Circuit Breakers
- Circuit Breakers
- Circuit Breakers

and many other products. Available in hermetic sealing. Write us regarding your requirements.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

# Featherlight

**HIGH STRENGTH  
AIRCRAFT QUALITY STEEL  
AN364 THREAD HEIGHT  
.062 THREAD RELIEF**

Series 12600 self locking, sheet metal nuts are designed as the ultimate answer for light weight AN362F-AN366F series anchor nuts.

The thread relief design eliminates the need for the fast shim, thereby making the lightest assembly possible.



These high strength, low height anchor nuts are fabricated from A.E.S.I. 4130 aerospace quality steel. They exceed requirements of Spec. AN-N-5 and AN-N-10 and are designed to meet requirements of MIL-N-25027 (ASG).

Self locking, sheet metal nuts in Series 12600 withstand temperatures up to 550° F and employ the triple lock locking method.



COILING SOON. Other styles and types in this basic design.

## Nutt-Shel

811 Highway, Glendale 1, California. Telephone: DRegans 5-3885 and GLOve 8-4131  
MANUFACTURERS OF SELF LOCKING NUTS AND NUT & NUT RETAINERS

power should approach that of reciprocating engines.

FIG. 12



The maintenance costs for the gas turbine were also estimated to be higher than for the reciprocating engine in the above comparison. An engine experience is gained with this new type of power plant, however, the simplicity of the engine, and its ability to operate for extended periods of time at points at or near normal rated power should result in overhead periods less than double that of current reciprocating engines in helicopter service. The continuation of the increased service life with the decreasing cost of replacement parts should bring the maintenance costs for the gas turbine well below those for the reciprocating engines.

Another factor not considered in the cost analysis is the possible decrease in engine maintenance and depreciation caused by the absence of vibration. There is no way of estimating accurately what this effect might be, but infinite depreciation accounts for almost 30% of the total direct operating costs and any decrease in this item could appreciably offset the total.

The cost figures shown for the gas turbine engine have been based on a free turbine configuration as mentioned previously. A single shaft gas turbine is suitable to the reciprocating engine in its speed power relationship; however, power plant cost will be reduced at some 1000 rpm, and high speed operation at cruise power results in decreased efficiency. The effect of this inefficiency on the operating costs of the 17,000 hp helicopter is shown in Fig. 10. While no light weight and great at a decided advantage in the reciprocating engine, it cannot approach the operating economy possible with free turbine engines. For this reason, the almost every new gas turbine engine being developed for helicopter propulsion is of the free turbine type.

Several new gas turbine engines are now being developed specifically as helicopter powerplants, in addition to a few current gas turbine engines which have been adapted for helicopter use. The gas turbine and the helicopter industries, both entered since World War II, are moving up to being to the air-minded population a revolu-

tionary new transportation medium. If the proposal to have new helicopters powered by conventional engines as adopted by the military, turbine powered helicopters may be in commercial operation within a few years.

## NACA Studies Air Dumping

It's just as important and difficult to shoot high pressure air to the outside atmosphere as it is to take it in board the aircraft.

Designs of exhaust flow systems have been hampered by the lack of

available data on discharging high-pressure gas into a turbulent stream, outlet configurations have been experimentally devised and were not necessarily best from design or pressure considerations.

A series of tests have been made by NACA at Langley Laboratories to develop outlets to solve the problem of exhausting high-pressure air in an efficient manner. Data for discharge coefficients and pressure distributions near the outlets have been accumulated in a Technical Investigation of Air Exhausting Characteristics of Small Inboard Air Outlets at Transonic Mach Numbers (TN 1442), by Paul E. Dewey, Langley Aeronautical Laboratory.

If you like pretty dimples...

**ZEPHYR**  
Modern Ram  
Coin Method

**NO DEBURRING!  
NO CRACKING!**



**CRACK FREE**—100% safe dimples are assured with Zephyr's air coin dimpling method.

**IT WILL BE WELL WORTH WHILE** to examine Zephyr's dimpling method of casting No. 15. There is conclusive evidence that Zephyr's method, in wide economical use, will:

- Eliminate disburment and radial cracks
- Speed control material distortion
- Provide perfect seating
- Assure proper flash distribution
- Eliminate all deburring
- Give perfect dimple dimensions
- Assure higher shear value
- Assure satisfactory true surface

## ZEPHYR

**MANUFACTURING  
COMPANY, INC.**  
Zephyr Division  
Glendale, California

**DEPT. ENGINEERING COMPANY INC.**  
Zephyr Division, Glendale, California  
PLEASE SEND ZEPHYR CATALOG NO. 15  
BY MAIL TO: ZEPHYR

NAME	COMPANY
ADDRESS	CITY
STATE	ZIP

**Engineered for  
fool-proof maintenance ...  
Edison's continuous cable  
fire detection system**



Now a solid cockpit cable leads to a control assembly designed without electronic tubes or complex mechanisms, requires maintenance-free service with least amount of personnel handling. Low appearance operation eliminates possibility of false alarms due to moisture or inactive effects in the new Edison aircraft fire detection system.

Another important development from the world-famous Edison Laboratory that increases the reliability of this system is its ability to signal fire even with a break in the sensing cable.

Check these other outstanding features, too:

- **Lowest expenditure**—from 11 volts d.c. without expenditure of any kind.
- **Simplest installation**—no wiring, no soldering, no cutting, no drilling.
- **Simplest operation**—simple "Fire Off" automatically responds regardless of fire exposure.
- **Simplest inspection**—permits installation in irregular and inaccessible spaces.
- **Continuous monitoring**—a single detector can and may have varying temperature alarm points.
- **Simple to install, easy to maintain**—adjusting spring chains release cable assemblies in seconds, and there are no brittle parts to fracture in the ready-fused cable.

Here is the **fastest fire detection system**... especially designed for today's high-speed, high-performance aircraft. If you today for complete details.

*Thomas A. Edison*

A GREAT NAME CONTINUES GREAT NEW ACHIEVEMENTS

**Thomas A. Edison**  
INCORPORATED

INDEPENDENT DIVISION • 10 LAKESHORE AVENUE • NEW BRUNSWICK, NEW JERSEY

## THRUST & DRAG

From Dick Bean, a Lockheed drone-bomber who has earlier commented on such drone subjects as supersonic fish (Sukono) and Mackay Radio, comes this story of how some Super Constellation was held on the ground by a bunch of thrushes.

The soundproofing material was to blame. It didn't meet flameproofing specifications and delayed final rollout of a batch of Super Constellations. Thus, thrushes tied these down.

Bell Telephone's little propaganda folder that comes with your phone bill each month is a fascinating journal, with local stories, some national about Bell's contribution to industry or the home, and clever arguments for getting an extension phone.

One of the company's recent folders has a rather intriguing thought about looking into cybers and Niles.

"When an operator dials a number 3,000 miles away," the booklet states at the bottom of a page about Niles, "the transmission across the land a great variety of devices to go to work to track down that one telephone, out of many millions, and ring its bell within a few seconds' time."

Now let's paraphrase that one: "When the fire-control officer dials a number sixty miles away, he miraculously locates the under and Niles do go to work to track down one among millions, out of many attacking each, and to blast it out of the sky within a few seconds' time."

You can get ideas from the simplest places.

There's a flap on in England right now about the lack of oxygen seats in new contemporary plane craft by both RAL and Bristol.

Reporting the story, the London News Chronicle printed some scathing questions about the situation.

"When the aircraft was stopped, no oxygen seat was available that could be fitted into the cockpit layout," Sir Mervyn and Mervyn.

"When the specification was laid down by the Service department, no oxygen seats for the pilot and navigator were added,"—Manufacturers of the aircraft.

"If oxygen seats had been added too, they could have been made!"—Manufacturers of oxygen seats.

"The first aircraft flew in 1944 and the two-seater version in 1951. Surely something could have been done in all those years!"—Pilot.

So there you see.

—DNA

## ENJAY BUTYL

outstanding for...

**AUTOMOBILE  
AXLE BUMPERS, TOPS,  
WINDOW SEALS, HOSE**

**HIGH VOLTAGE  
POWER CABLE  
INSULATION**

**LONG-WEARING  
AGE-RESISTANT  
TRACTOR TIRES**

**THE PRODUCT  
YOU  
MANUFACTURE**



Enjay Butyl resists heat and cold... won't skip or crack... resists chemicals... retains flexibility and resilience... resists the aging effect of sunlight and ozone... is impervious to oil and other gases. Enjay Butyl is the only type of rubber, natural or synthetic, that offers this combination of advantages—and at low cost. That's why Enjay Butyl is being selected as the best rubber for more and more industrial products.

To find out how Enjay Butyl can improve your product, contact the Enjay Company. Our technical representatives and laboratories are at your service.

ENJAY COMPANY, INC., 15 West 51st Street, New York 20, N. Y.  
District Office: 11 South Parlane Path, Akron 3, Ohio



ALUMINUM HONEYCOMB is set up on benches, ready for cutting. DISASSEMBLED F-102 STABILIZER shows new tapered aluminum core.



F-102 STABILIZER with honeycomb joined 10% more rigid than conventional structure. F-101 STABILIZER trailing edge has core.

## New Fighters Use Resin-Bond Honeycomb

By Irving Stone

Sea Dayco-Honeycomb structures developed for high production applications are helping to accelerate the structural revolution in aircraft detail design.

All-metal honeycomb sandwiches—bonded by resistance welding or brazing—are still largely under development; resin-bonded sandwiches structures have been refined for production use.

Details of these structures include high strength-weight ratios, inherent rigidity and aerodynamic smoothness.

### F-102 Applications

The important role resin-bonded metal honeycomb is playing in airframes and related components is highlighted by Navisco Mfg. Co.'s production of typical parts for today's fast aircraft.

• **Conical F-102 wing tip.** The unit for the responsive interceptor measures

approximately 41 ft. long, 25 ft. wide, with thickness varying from 24 in. to 3 in. The configuration has compound curvature incorporating twist. The part weighs about 15 lb. against a conventional sandwich weight reported to be about twice as much. Constant speed operating temperature is 300°F for instantaneous operation; the part could go to 550-670°F.

Navisco Products core is 1-in. (cross-hatch) 602 aluminum. Skins are 3/64-in. 7050 Alclad. Type is made from two 7050 extruded T-sections. Perforator is a series of responsive cuttings. Closing end rib is 7050 bonded sheet.

Embedded in the structure is a navigation light with 1-in. diameter conduct running through the center of the cone.

In tip, and the other F-102 applications which follow, bonding of core to core sections and core to skins, flange ribs and fittings is done with Shell

Epoxy 8 high-viscosity adhesive because of its void-free characteristics. The bonding is done in an oven, but not under pressure other than a vacuum to keep the parts in intimate position to each other.

Final bonding of skin to the sub-assemblies of core, spine and perforator fittings is done with Navisco's 402 high temperature type in an oven at 350°F for 2 hr. at a pressure of 45 psi. This pressure is used to insure close distribution of force to overcome effect of dimensional discrepancies.

• **F-102 stabilizer.** This unit is about 41 ft. long, 24 ft. wide, with thickness varying from 3 in. to 1 in.

The core is 4-in. 602-in aluminum. It is tapered for bonding, and a slight compound curvature is obtained in hand-molding.

Spine is 1/4-in. aluminum channel. Trailing edge portion is a compression

casting. Hinge and control arm fittings are machined from aluminum alloy forgings. End cleaves ribs are sheet metal.

Skins are tapered 758F. Under the skin, at the spine and lower cleave ribs is a 1/4-in. tapered doubler.

In strength comparison tests a conventional doubler of aluminum sheet metal construction failed at 146% of ultimate design load. The aluminum honeycomb sandwich doubler of same weight failed at about 175% of ultimate design load, proved to be about 50% more rigid than the conventional structure.

• **F-102 elevator trailing edge.** These components vary in length from about 6 to 8 ft., are approximately 8 in. wide. Core is 4 in. by 1 in. 602 aluminum honeycomb with thickness tapering from about 2 in. down to 1 in.

Spine is 758F aluminum. Face skins are compression 270-in. 7050-F102s are machined aluminum alloy.

A thin metal doubler extends from the spine half way the honeycomb for about 2 in.

• **F-102 wing fences.** These units run from about 18 to 7 ft. in length. Re-entrant and fences of the same size they are considerable weight.

Core is 4-in. by 1 in. 602 aluminum honeycomb about .133 in. thick. Two skins are .018-in. 245T3. Core is sealed with coating of 016-in. Deboned Magnesium T-section extension at truss face to nose.

• **F-102 nose wheel door.** Core for this part is about 2 in. thick, with a tapered outer edge. Edge of the part is a drop flange 3/16-in. Skins are 245T.

Overall measurement of the door is about 44 in. by 2 ft.

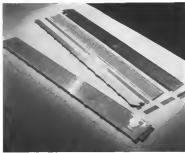
The honeycomb molding ribs angle and provide the rigidity necessary in this type of cast.

### F-101 Applications

• **McDonnell F-101 stabilizer trailing edge.** This ornate stabilizer portion is approximately 3 ft. long, 31 ft. wide tapering to about 1 ft. in width at the



F-102 WING FENCES have cast skin made with attached to wings with T-sections.



F-102 ELEVATOR trailing edge. Complete unit is in deepwork, parts are behind it.



F-102 WINGTIP is sectioned to show core.



HARMCO makes 20 ft. long sandwich part.

outboard end. It is approximately 3 in. deep at widest section.

Construction of the part, a long V-section, has the tapered angle changing about 4 deg. from inboard to outboard. This requires that the core (1-in. by 1-in. 602-in. foil aluminum) be cut to a varying angle throughout its entire length.

The 245T 602 faces are bonded to the honeycomb by Navisco's 302 general purpose adhesive in oven, instead of the company's 402 adhesive.

Spine and cleave ribs are formed of 3/16-in. 265F sheet. A tapered doubler bonded between face and core extends from the spine to the trailing edge. Core under the doubler is of a different density and has its aluminum running at 90 deg. to those in remainder

of the part's core. These two cores, one 1/4-in. and the other made by Flom Mfg. Co., are edge-bonded to each other.

Core steps 1 in. from the trailing edge and an epoxy joint is extruded into the opening to provide the part with a tough edge.

• **F-101 stabulator trailing edge.** This unit has no twist in effect is a simplified version of the stabilizer.

The component is about 54 ft. long, tapering from about 11 ft. wide at base and to about 1 ft. at upper end.

### Metal-Glass Plastic Structures

Another large honeycomb structure Navisco manufactures for a Convair plane is about 20 ft. long, about 5 ft. in diameter at the widest point of the

the industry's choice for  
better fabrication...

## AVIATION FABRICS

to specification by

**Sawyer**

... for highest quality  
canopy covers...  
interior trim... insulation

Backed by more than 100 years of extensive laboratory facilities in the hands of expert research engineers—SAWYER'S Coated Aviation Fabrics set the standard for the highest quality product available to the aircraft industry—vinyl coated canvas, nylon, glass cloth and other synthetic fabrics. Contact your nearest representative or write us for samples of our Specialty Aircraft interior and exterior coated fabrics as well as our up-holdery fabrics for interior trim with our Aeronautical Finishes—manufactured in all types, colors, weights and widths to government and AAF specifications.

### THE H. M. SAWYER & SON CO.

Coated Fabrics Division... Established 1840  
WATERTOWN 72, MASS.      WATERTOWN 4-0530



1950 GRAND II

NEW YORK: Webster, Schuch, 38 East 43rd St., Midway Bldg. 5th Fl., William E. Mitchell, 15 West 28th St., Midway Bldg. 4th Fl. 40790  
ATLANTA: American F. Moore Co., 33 Con St., N.E., Cramer 4218. CHICAGO: D. Russell & Co., 321 South Peoria St., Taylor 7-7071. DALLAS: W. L. Davis Co., 1507 Congress St., Randolph 5477. KANSAS CITY: W. C. Miller Co., 1845 Warren, Grand 4850. LOS ANGELES: John Swisher, 214 South St., Andrews Pl., DUBUQUE 7-1257. ST. LOUIS: R. C. Karp, Inc., 37 Ardmore St., Shure 1740.

typical shape. It is composed of eight main sections.

Only the core is solid. The rest is a 1-in., 303-in. aluminum foil Mylar-type material manufactured by Narman Resins & Coatings Co., and selected because of the intricate compound curvature of the surface. It is bonded to Narman's phenolic impregnated fib-

berless Cores with the company's 332 adhesive.

These Cores have an .010-in. thick, except at periphery of the individual sections and at access doors, where the sandwich structure is replaced by 1-in. solid Cores edging.

The upper sections are bonded and riveted together.

## Converted Millers Speed Output Of North American F-100 Wings



CONVERSION OF SKIN MILLER by Simmons speed NAA pace and output, compared with processing of new metal. Machine will make outpiled diffused F100 wing skins.

By Henry Lafer

Albion—Conversion of a 13-imp.-cm, 100,000-lb. per plate to a modern, lightened skin roller for machining aircraft diffused aircraft wing sections has just been completed here by Simmons Machine Tool Corp. for North American Aviation, Inc.

The converted miller is proving such a boon of one difficulty at operation at NAA's high-speed. Both machines are owned by the plant bought by North American from government surplus for maintenance. NAA engineers rebuilt the old mill in operation and modified the roller set in Simmons. The cost is perhaps enough to one third that of one machine to do a comparable job, according to Simmons. And because of the inherent rigidity in the heavy roller plate, the conversion can prove superior to new machines of the same type, says Charles Mulvihill of NAA's Industrial Engineering Dept., who is in charge of the conversion project.

The skin roller is set up for an ultrasonic cutting of outpiled diffused upper and lower skin for the F-100 Super Sabre. In acceptance tests Simmons saw for North America, right-

hand upper and lower sections were cut rapidly in a better grade than 7 hours each. It produced consistently, the time per panel would be cut in half. Simmons' works manager, Pat Rosen, says the machine's average ingested cut is only about .70 in. thick. However, Mulvihill says that NAA will undoubtedly run the machine faster, giving a shorter production time, when it is used in its permanent location at high speed.

With skin rolling the machine can be adapted to other jobs. Using five sections clamping it can produce five 8-100 leading edge patch sections each. It will accept 1-in. 7854 aluminum plate 10 ft. wide by 24 ft. long, and can be adapted to make thicker plate. The machine itself is 12 ft. high by 25 ft. wide by 38 ft. long. Two 50-hp. tailing leads take the plate of the work point looking on the ingested roller machine. The carbide tipped rollers are 2 in. wide and 14 in. in diameter. Mounted on the spindle one of the rollers that turn at 1,500 rpm has a surface speed of about 15,000 fpm, removing material at a rate up to 210 in. in 1 min.

Compressed cutting feeds vary from 20 to 150 in./min.; traverse feeds are

## MORE SERVICE PER DOLLAR



### DARNELL CASTERS & E-Z ROLL WHEELS

... OVER 4000 TYPES  
OF CASTERS & WHEELS

All types of rubber treaded - poly, stainless and hard - for smooth operation on all kinds of floors. Featuring Neoprene rubber tread - resistant to grease, water, oxidation, oils and acids and reinforced by steel chordless - especially recommended by Darnell standards in our own rubber factory.

All Darnell Casters - whether steel or rubber treaded, are available with various big plate, cone and flange for any type of application. Or, Darnell engineers will gladly design a special type roller for your own industrial equipment. Demand Darnell for Dependability.



### DARNELL CASTERS & WHEELS

Always **S-A-W-Y-E-R**  
and **R-O-L-L-E-R-S**

Free Manual

DARNELL CORPORATION 170  
HAWLEY ST. NEW YORK 10011  
NEW YORK 10011  
NEW YORK 10011  
NEW YORK 10011



Maximum efficiency of centers of the oil-cool type built, and the oil-to-air type (left) employ all latest construction for maximum strength, weight and



Highly resistant to temperature, pressure, vibration and wear.

## Progress In Oil Coolers . . .

Based on unique, proprietary processes for producing and brazing thin metal sections, plus the largest wind tunnel laboratory facility of its kind, the Clifford Company has pioneered the major developments in this field since 1940.

As flight conditions become increasingly severe with the drive for higher speeds over greater altitude ranges, temperature regulation of engine lubricating oil becomes a critical, complex engineering factor in aircraft capabilities.

The industry's major requirements:

oil cooling is *per-se* an engineering problem, but today become complex heat exchanger problems further complicated by the need to provide adequate heat rejection capacity within strict limits of size, weight — and sometimes even shape.

These unique needs Clifford brings to bear in aircraft heat exchanger problems have been largely responsible for the fact that it has attracted the major attention in the oil cooler field since 1940.

One asset in Clifford's ability to produce and fabricate thin metal sections, based on its own developments in deep drawing and extrusion.

Another is its multiple proprietary process for brazing thin metal — particularly aluminum — which is unmatched by any other process.

Third is Clifford's wind tunnel laboratory — the largest, most completely equipped laboratory facility of its kind.

Clifford's background since the company's inception in 1930 was in the aluminum oil coolers whose products had been tested and proven.

First test setting of evaporating engine oil cooler



Production line repeat extrusion of aluminum heat exchanger tubes.



Double-height construction in typical branch application of Clifford's design for optimum consistency of characteristics, pressure and/or heat

Typically, it broke into this field by developing the new, superior hydraulic forming method of producing hollow which today is the standard process throughout the world.

Expanding their aerial activities to produce products for the control of heat, proved realistic, basic experience to back up Clifford's entry into the aircraft field.

The deep drawing and extrusion process attracted the attention of the aircraft industry in the pre-war preparation days and Clifford was asked to produce design data for the manufacturers of aircraft oil coolers and coolant regulators.

Once acquainted with the field, it was not long before Clifford's metallurgical background uncovered an area of opportunity. Engine coolers were not wholly satisfactory. The deep drawing method of forming the tubes as standard for metal heat exchanger tubes were concerned in problems of only 100 psi in air. With oil pressure levels, the situation was quite different, the situation was quite different, the situation was quite different.

Free years of metallurgical research Clifford had resulted in a unique, proprietary process for treating thin aluminum sections. Combining its earlier development in deep drawing and extrusion of thin tubes, Clifford independently designed and produced the first aluminum oil cooler and coolant regulators.

The test unit weighed only one-third as much as conventional copper coolers and life cycle tests showed a far higher service expectancy. The air industry gave their enthusiastic approval and Clifford found itself in the forefront of a new field.

First to use the new aluminum oil cooler and coolant regulators were the Army, Navy, and Air Force. The Air Force quickly followed. As the work and Clifford was the sole producer of aluminum oil coolers whose products had been tested and proven.



Clifford's famous P-28 was among the first military aircraft to use Clifford's early developed aluminum oil-coolers and coolant regulators.



Carbide-coated oil-coolers used in various types of aircraft engine cooling systems.

Early jet engine cooling along after the war shifted on all engine development was simply expanded on the turbine and then moved forward. And with General Electric's contract to produce the J-47, Clifford was asked to develop a complete cooling system.

A completely new concept of oil cooling was suggested by Clifford. Since jet engines were made of steel it was possible to pass cold fuel on one side of the heat exchanger, hot lubricant on the other. With the flow reversed by diaphragmatic valves, the lubricating oil is kept at optimum temperature.

The new design, since it did not depend on ram air for cooling, could be located out of the jet stream and more easily serviced. These and other advantages caused it to be adopted as standard for military jet aircraft.

Later improvements resulted in substantial weight reductions and the elimination of numerous parts. Employing an extruded aluminum alloy finished by its proprietary heating process, Clifford is today the only company able to produce these superior aluminum oil-coolers and coolers.

Clifford's wind tunnel laboratory plays an increasingly important role in testing the company in the development of aircraft heat exchanger developments. Ability to simulate service conditions with most accuracy simulates the need for time consuming, expensive field tests. New designs in its vast store of empirical knowledge permits rapid transition of thermodynamic theory into practical design without need for a substantial of pilot models.

In few companies to have such a direct linear connection between research and production as can be found at Clifford.

New developments, still under military or proprietary contract, include a new oil cooler design based on using the latent heat of vaporization to cool the oil and nitrogen plant of the fuel because it cools the combustion chamber.



Clifford's H-2700 engine exhausts are installed in a world's speed record, across a Clifford oil cooler.



Advanced, simplified design of liquid fuel oil cooler for Boeing jet (left) shows obvious advantages over original design pioneered by Clifford Company.



Reduced weight, weight reduced 25%, and a stronger, uniform, all-steel construction reduced.



A great reduction in weight and bulk is achieved.

Another feature is special oil cooler for afterburners which automatically cuts in and out with the operation of the afterburner.

Recent oil cooling systems for jets take care of "high altitude cooling" conditions. When fuel flow drops too low to provide adequate cooling, thermostatic valves cut in on secondary air type coolers.

Helicopters pose peculiarly difficult problems. Changes in direction from horizontal to vertical flight — or in hovering — makes their oil cooling demands highly variable. Clifford is currently developing two systems to these problems. One is an engine cooler placed in an engine inlet air stream. The second employs an air-type cooler placed in the air stream, but having no external fan driven by a heat motor. Oil temperature determines the operation of the fan through the action of thermostatic valves.

Reactors, missiles and space equipment are other areas in which Clifford is working. The company is also doing another engine heat exchanger involving the burning of engine exhaust.

In all these areas, Clifford's unparalleled facilities in aircraft heat exchanger and its unique ability to produce, fabricate and treat thin metal sections by proprietary processes is largely responsible for its present lead, today in aircraft heat exchanger design.

For further information write Clifford Manufacturing Company, 150 Greenwich St., Boston 30, Mass. Division, General Dynamics Corporation, Offices in New York, Detroit, Chicago, Los Angeles and Washburn, Mass.



Illustration of oil-cool type and cooler on jet engine.

Wind tunnel test of aircraft type heat exchanger assembly that shows how Clifford's cooling coils and sections, and is used in aircraft heat exchanger systems.



Heat exchanger oil temperature regulating system, one designed and manufactured by Clifford for all engine applications.



Illustration of oil-cool type and cooler on jet engine.









## Field-Effect Transistor Raises Semiconductor Frequency Range

By I. M. Ross

The "field-effect" transistor is one of the latest additions to the transistor family.

Although it operates on a principle quite different from that of the point-contact or junction type, it is capable of performing most of the same functions with its application as amplifier, oscillator, and so on. It has the advantages of small size and low power consumption common to the others.

The development of the field-effect transistor is not a very recent thing. It should have been clear that it has been as predicted in theory and, in particular, that it should eventually be capable of operating at appreciably higher frequencies than can the point-contact and junction types.

It is the possibility of obtaining the higher frequency response that is the most interesting feature of the field-effect transistor.

### Underlying Principle

Although the field-effect transistor is one of the most recent of the transistor family, its basic idea is not a new one. It is the underlying principle of the device is illustrated in Figure 1.

As shown in recently of a thin sheet of conducting material with electrical contacts at each end and a metal plate close to but not in contact with one surface. The surface of the conductor and the metal plate then form a capacitor. By applying a potential to the plate, a field will be set up in the conducting slab and, if the potential is positive, it will tend to push the current carriers away from the surface of the material. The net result of this will be a decrease in the total number of carriers in the material and hence an increase in the resistance from end to end of the slab.

If the device is connected as shown in Figure 1, when the key is closed, the current through the slab will decrease. It is therefore possible to control the current through the slab by means of the potential on the metal plate and, if the electrode between metal and slab were perfect, this can be done.

This action is measured in standard tests by the "transfer" characteristic, which is shown in Figure 2. The curve shows that the current through the slab can be controlled by applying a voltage to the metal plate.

Also when the current is the field changes, the power dissipated in it will change, and since the current power is essentially zero, there would be power amplification.

The principal problem in the construction of the field-effect transistor was to find a suitable material for the slab. Since the material had to be a semiconductor, all semiconductors were considered.

Metals, on the other hand, contain such high densities of current carriers—electrons—that it would require an impractically high potential to give an appreciable percentage change in the current flowing.

Semiconductors, however, have densities of current carriers lying between those of conductors and those of insulators and are ideally suited as "field effect" transistor materials. In 1948, W. Shockley and G. L. Pearson of Bell Telephone Laboratories used germanium to make a structure similar to that shown in Figure 1. They found that this was able to affect the current through the germanium by means of the potential on the metal plate, but that the control carriers were not holes but electrons. If the potential is made positive with respect to the slab, then electrons will be pulled across the junction from the n to the p-region, while holes will move in the opposite direction. Because of the

### Loss of Sensitivity

It was pointed out by J. Bardeen that the loss of sensitivity of the device could be attributed to conductance at the surface of the germanium slab. At the surface, the arrangement of atoms is different from that in the bulk of the material, and hence the electrical properties may also be different.

In effect, what Bardeen proposed was that the free surface acted as an electrical source that tended to produce a field from protruding into the bulk of the material, thus decreasing the effect of the field on the resistance of the slab. It was during an investi-

gation to test this hypothesis that Bardeen and W. H. Brattain invented the point-contact transistor.

The field-effect transistor in its original form lacked sensitivity, because of the effect of the germanium surface. The ideal would be to have a capacitor situated exactly under the germanium slab to eliminate surface effects. This can be achieved by using what is called a p-n junction.

In a semiconductor like germanium, there are two important ways in which conduction can occur.

In the first, conduction takes place by the movement of electrons, which, being negatively charged, move in a direction opposite to the electric field. A semiconductor in which conduction is due, primarily to the movement of electrons is called "n-type," the "n" standing for negative.

In the second type, conduction is due to the movement of what are called "holes," which may be considered as particles having about the same mass as that of an electron but having a positive charge. Hence, holes will move in the same direction as the electric field. A semiconductor in which conduction is due primarily to the movement of holes is called "p-type," the "p" standing for positive. It is possible to make germanium exhibit one or the other, depending on the chemical elements added during growth of the crystal.

### P-N Junction Transistor

A p-n junction specimen may be defined as a piece of semiconductor containing two regions, each having a type conductivity, and the other type. The junction at which the type of conductivity changes is referred to as "the junction."

Such a p-n junction is shown in Figure 2(a), where the distribution of current carriers (holes and electrons) are represented schematically. In the slab and across the whole. If the potential is made positive with respect to the slab, then electrons will be pulled across the junction from the n to the p-region, while holes will move in the opposite direction. Because of the



FIG. 3. Field-effect transistor using a p-n junction to produce a "transfer" action. A voltage that is applied between the p and n-type materials creates a potential barrier of space charge, forcing a region within the body of the n-type material that will not contribute to current flow through the semiconductor.

motion of these charges, a current flows, and the current increases with increasing applied voltage. Under these conditions, the junction is not to be biased in the "forward" direction, and it has a low impedance.

If, however, the specimen is made negative with respect to the region, both the electrons and holes are pulled away from the junction, and there is no current flow across the junction. Under these conditions, the junction is said to be biased in the "reverse" direction and it has a high impedance.

### Reverse Bias

A rapid analysis of a p-n junction biased in the reverse direction shows that there is a small but constant current flow, in the order of a few microamperes.

This current is independent of the magnitude of the applied bias and is therefore called the "saturation" current. The saturation current shows that all the voltage drop occurs in a region close to the junction itself. In fact, the electric field in that region is sufficiently high to pull all the charged carriers (holes and holes) out of it.

This situation is shown in Figure 2(b) where the charged carriers have been removed from a region on either side of the junction. Such a region is called a "space-charge" region. Since it contains no current carriers, it can not support conduction and will then, for all practical purposes, act like an insulator. However, this region is bounded by conducting regions of p- and n-type conductivity.

A p-n junction biased in reverse is, hence, equivalent to a resistor with plate separation equal to the total width of the space-charge region as shown in Figure 2(b). If the voltage across the ends of the junction is increased, Figure 2(c), the charged carriers are pulled further from the junction, increasing the width of the space-charge region and, therefore, increasing the plate separation of the equivalent capacitor.

Thus, in the reverse voltage across a p-n junction is increased, the capacitance of the junction should decrease.

The p-n junction has the desired properties for use as a field-effect transistor, and Figure 3 shows the reaction equivalent of the semiconductor field-effect transistor. Such a unit could be used as an amplifier. However, there is a serious interfering and useful form of the transistor shown in Figure 4(b). This device, in which a bias is not applied on both sides of an n-type slab and the two regions are connected.

Consider what happens if the p-region is short-circuited to the left end of the n-region and a positive potential applied to the right end, Figure 4(b).

A current,  $I$ , will flow in the direction of these charges, a current flows, and the current increases with increasing applied voltage. Under these conditions, the junction is not to be biased in the "forward" direction, and it has a low impedance.



FIG. 4. Schematic diagrams of a field-effect transistor, showing the effect of the space-charge region and current-voltage characteristics for (a) zero gate voltage and small drain voltage, (b) lower drain voltage, (c) positive gate voltage, (d) negative gate voltage, (e) positive gate voltage, (f) negative gate voltage, (g) positive gate voltage, (h) negative gate voltage, (i) positive gate voltage, (j) negative gate voltage, (k) positive gate voltage, (l) negative gate voltage, (m) positive gate voltage, (n) negative gate voltage, (o) positive gate voltage, (p) negative gate voltage, (q) positive gate voltage, (r) negative gate voltage, (s) positive gate voltage, (t) negative gate voltage, (u) positive gate voltage, (v) negative gate voltage, (w) positive gate voltage, (x) negative gate voltage, (y) positive gate voltage, (z) negative gate voltage.

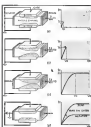


FIG. 5. Theoretical characteristic curve for field-effect transistor with gate voltage in the p-region.



FIG. 6. Theoretical characteristic curve for field-effect transistor with gate voltage in the n-region.



FIG. 1. Schematic representation of a field-effect transistor at a certain design to illustrate how current through the slab can be controlled by applying a voltage to the metal plate.

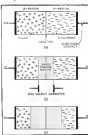


FIG. 2. Distribution of holes and electrons in a p-n junction. (a) no bias voltage applied, (b) a reverse bias across regions of charges produces a space-charge region and makes the material equivalent to a capacitor, (c) a large reverse bias producing a wide space-charge region.



FIG. 3. Field-effect transistor using a p-n junction to produce a "transfer" action. A voltage that is applied between the p and n-type materials creates a potential barrier of space charge, forcing a region within the body of the n-type material that will not contribute to current flow through the semiconductor.



# BENDIX AIRBORNE RADAR

## World's first airline to use airborne radar in scheduled flight...and the radar is by Bendix!

Panagra is using, on scheduled flights of its new DC-7 fleet, the latest major contribution to safe, more comfortable commercial aviation... Bendix® Airborne Radar. It's Bendix Airborne Radar that gives Panagra pilots a long distance, all seeing, extra "eye" for avoiding turbulence. This radar is also used for terrain mapping and navigation.

### **Storm Avoidance**

Bendix Radar detects and sees through turbulence up to 150 miles away... even at night or under instrument conditions. It penetrates heavy rainfall and reveals smooth corridors through apparently solid storm areas. The naked eye can't see the quiet patches... but radar can.

With a slight descent from track, at cruise powers, storm avoidance means improved flight schedules... minimized flight course changes, few flight cancellations, more completed flights.

New Panagra passengers will enjoy smoother flying... greater comfort... guided through turbulent areas by Bendix Radar behind the referee... soon to become the most famous note in aviation.

### **"C" and "K" Bend Radar**

Bendix is the only manufacturer offering both C and K band radar. Send for free illustrated Bendix booklet, "Airborne Storm Avoidance Radar Systems."

**Bendix**  
**Radio**  
DIVISION

BALTIMORE 4, MARYLAND

**Bendix**  
AVIATION CORPORATION

AIR COMMUNICATIONS AND NAVIGATION EQUIPMENT • AIR DEFENSE RADAR • GROUND CONTROLLED APPROACH AIRCRAFT LANDING SYSTEMS • MISSILE GUIDANCE • AIRBORNE RADAR  
West Coast Sales: 15000 Maguire Blvd., N. Hollywood, CA; Export Sales & Service: Radio International, 201 E. 42nd St., N.Y., U.S.A.; Canadian Sales: Avionics Centre, 200 Lansdowne Blvd., Montreal, Que.

•Reg. U.S. Pat. Off.



## From the Stoddard-Dayton to the Super Sabre



### Speco's creative engineers have opened new horizons in precision!

If you recall the Stoddard-Dayton, then surely you remember the jeep—the sweetheart of World War I. They were a couple of kids who "grew up together"—the car and the airplane. And today their grandchildren are the successors of our national economy.

We like to feel that our leadership in precision on a mass production base has played a big role in this growth. Our work in all industries—automotive, aviation, industrial... in fact, in all fields of

mechanics and hydraulics—has made great contributions. Our team of precision engineers, technicians and modern tools makes certain that if you say it... We'll build it! If you have a job with which you feel we might help, a clear letter or a telephone call will have prompt, sound guidance. Or if you'd like the whole story—from plant to people to products, send for our new Plant Brochure. The Steel Products Engineering Company, Springfield, Ohio.

THE STEEL PRODUCTS  
ENGINEERING COMPANY



One of our early contributions to automotive—the two pistons. Copied from *Automotive Engineering* by Speco in 1924.



Today we're building precision motors for nearly every major manufacturer of nuclear equipment—and many other complex parts.

at high as 70 megacycles per second.

So far the work is still in an early stage and it is expected that much will be accomplished well ahead of the scheduled November date, the actual results have been very promising. On an experimental basis, field-effect transistors have been used in amplifiers and oscillators as well as in frequency and amplitude modulation circuits.

How does the field-effect transistor compare with other electronic amplifying devices?

As compared with electron tubes the device characteristics is very similar to the plate characteristics of a pentode tube.

The high impedance input characteristic is also similar to that of the pentode tube, and the values of transconductance and frequency response are comparable.

Thus, it appears that the field-effect transistor could perform many of the functions for which the pentode tube is now used. In addition, it has all the usual advantages of a transistor over an electron tube: being small, rugged and light weight, requiring no heater power, and possibly having much longer life.

How does it compare with a junction transistor?

There are a number of differences of practical importance. First, in the field-effect type, the current carriers are traveling in an electric field whereas in the junction transistor they are moving by diffusion. Since the velocity in a field is much higher than the velocity of diffusion, the transit time for transistors of the same size will be much shorter in the field-effect type. Since the maximum frequency of operation of both devices is limited by the transit time, the field-effect transistor is intrinsically capable of operating at higher frequencies (See *Felix Coates story, New III Transistors*, p. 18).

Second, the field-effect transistor has a high input impedance, whereas the junction transistor has low input impedance. This difference allows the junction circuit to be more easily matched to the other transistor more suitable in particular applications. The field-effect transistor, even with optimum design conditions, would probably not be capable of operating with such high efficiencies at such low power levels as the junction transistor.

It is too early in the development of the field-effect transistor to make definite statements as to its possible future use.

It would appear that it would find its main applications where considerations of size, weight and power consumption dictate the use of a transistor, and where the required frequency is greater than could be achieved with a simple junction transistor.

## Avionics Bulletins

Recent avionics bulletins and changes of interest to persons in the avionics field include:

• **Procedure for Transducer Installation** in the type of a scope includes (See Bulletin 101) available from General Instruments, 20 South St. 11202, Garden St., 22, 22, 22, 22, 22.

• **Digital data responses** to specific requests under type indicators from another or other similar-type system. Description and application engineering data is included in Scope Index (A-1071) A.C. Search Ring Ltd., General Motors Corp., 1120, East 1st St., North York, Ontario, Canada.

• **Resistor and condenser values** of a variety of types are described in Catalog No. 101, General Motors Corp., 1120, East 1st St., North York, Ontario, Canada.

• **What is the value** of the data on Scope

10-11, Scope is Technical Information Series, 10-11, Scope is Technical Information Series.

• **Procedure for Transducer Installation** in the type of a scope includes (See Bulletin 101) available from General Instruments, 20 South St. 11202, Garden St., 22, 22, 22, 22, 22.

• **Digital data responses** to specific requests under type indicators from another or other similar-type system. Description and application engineering data is included in Scope Index (A-1071) A.C. Search Ring Ltd., General Motors Corp., 1120, East 1st St., North York, Ontario, Canada.

• **Resistor and condenser values** of a variety of types are described in Catalog No. 101, General Motors Corp., 1120, East 1st St., North York, Ontario, Canada.

• **What is the value** of the data on Scope

## OUR DEFENSE LINE

FOR INVESTORS there's a challenge [et] ahead in designing for both the military and commercial markets.

**we have openings for ..**

- Aeronautical Engineers • Astronautical Engineers •
- Test Engineers Flight & Structural • Stress Engineers •
- Design Engineers • Electrical • Power Plant Installation •
- Equipment • Transmission • Vibration Engineers •
- Aerobics •

Positions available at all levels of responsibility. Salaries commensurate with training and experience.

Send resume of your employment background to Frank Cox, Employment Manager

**morton corporation**  
MORTON, PENNSYLVANIA





## PORTABLE CONTROL TOWERS

Transportable by helicopter or truck. Available in a variety of models — in 15' with facilities to suit requirements. Features state-of-the-art instrument landing and warning equipment, analogized to instruments, and field lighting control facilities.



Most towers provide tower bells, signal to top of structure, and air holding equipment installed. Customized towers available in any height.

Consult us for your control tower requirements.

**Wickes ENGINEERING AND CONSTRUCTION COMPANY**

1001 SHUT AND WEST AVENUE, CLEVELAND 18, OHIO

GARDEN 2, NEW YORK



## Have you heard about Permadizing?\*

\*Stillman's exclusive Permadizing Process for rubber-to-metal bonding allows designers to specify steel-to-steel rubber-to-metal bonded parts under a wider range of temperature and pressure than ever before. It's a high-pressure process, too, giving consistent, variation-free results even over the longest runs.



Sent for Free when calling 988

**Stillman Rubber Co.**

23628 Lorain Rd., Cleveland 26, Ohio - 2511 Worley Ave., Culver City, Calif.

## AVIATION CALENDAR

- July 3-4-For Peter Auer, second annual East T. Kerk Memorial Trophy competition for Air National Guard jet pilots, Los Angeles to Detroit
- July 2-3-Second annual Western New York Air Show and Races, Dutchess Airport, Champlain, N. Y.
- July 2-4-International Aviation Exposition, Detroit-Wayne Major Airport, Detroit
- July 2-4-North annual Air Western Transportation Air Race, Long Beach-Cold Springsfield, Mass.
- July 2-14-Twenty-second National Sporting Car Show, Hershey 1913 Events, N. Y.
- July 1-7-Office of Naval Research and Naval Aeronautical Co., international symposium on radar tubes and naval radar programs through standard media Navy Electronics Laboratory, San Diego
- July 11-22-Special summer program in Architecture of Detroit Free Press, Detroit Institute of Technology, Detroit
- July 12-14-Western Plant Maintenance and Exposition Show, sponsored by Chicago and Pacific, San Francisco, Anaheim, Los Angeles
- July 15-16-Philadelphia Glider Council, annual open house, Philadelphia Glider Club, Haverhill, Pa.
- July 27-29-Restoration Thirteenth Congress, Rotterdam, The Netherlands
- Aug. 10-Experimental Aircraft Assn., third annual Fly-In and Convention, Central Wright Airport, Milwaukee
- Aug. 11-16-Institute of the Mechanical Sciences second National Teaching Forum of Air Transportation Meeting, Chicago Hotel, Seattle
- Aug. 18-14-Air Force Assn. Convention and Aerosol Symposium, San Francisco
- Aug. 19-21-Society of Automotive Engineers, West Coast Children's American Machine, Hotel Mohawk, Portland, Ore.
- Aug. 22-23-Symposium on Electronics in Automatic Production, sponsored by State Res. Research Institute and the National Industrial Conference Board, Skutumpah Valley Hotel, San Francisco
- Aug. 24-25-Western Electronic Race and Convention (WESTREC) Convention, Sheraton and Fairmont Hotel, San Francisco
- Aug. 24-25-International Sports Car Show, sponsored by Sports Division of Reader Aviation Corp., Albany, N. Y.
- Sept. 3-5-Two-day, annual National Aircraft Show, Philadelphia International Airport
- Sept. 14-16-Second Denver & Pikes Peak, eighth annual Roundup Flight Show, New York to Colorado
- Sept. 12-16-International Society of America, 17th annual Convention, and Exhibits, Sheraton Exposition Hall and Auditorium, Los Angeles
- Sept. 17-Institute of Radio Engineers, Symposium on Automation, Cedar Rapids, Iowa
- Sept. 25-29-American Institute of Electrical Engineers and Institute of Radio Engineers, 1957, Industrial Electronics Convention, Park Sheraton Hotel, Detroit
- Oct. 1-5-Eleventh annual National Electronics Conference, Hotel Sheraton, Chicago



TED E. BORTNER



GLEN HEADMAN

### Meet Ted Bortner and Glen Headman,

Westinghouse AGT field service engineers, headquartered in Dallas, Texas, and Edwards Air Force Base, respectively. These men and their teammates in your area offer you the benefits of years of aviation experience and are backed by a headquarters staff of engine service specialists. They can help you with many service problems. For example, they can give you complete information on the product described on the next two pages.

## New silicones that run clean at extreme speeds and temperatures



Shown here is Dr. G. C. Greer, the Westinghouse scientist who developed the lubricant. The struggle of the new silicone he is pouring was tested to 440°F for over 100 hours, yet it remains clear. The conventional lubricant at the left shows a large degree of sludge formation after only four hours at 480°F. A9H1A

FOR MORE INFORMATION ON WHAT THIS NEW LUBRICANT WILL DO FOR YOU . . . TURN THE PAGE

YOU CAN BE SURE...IF IT'S **Westinghouse**



TOMORROW'S AIRCRAFT: *One step closer*

## New silicones run clean at extreme speeds and temperatures



Out of the Westinghouse Materials Engineering Laboratories and the Avionics Gas Turbine Division has come a new silicone lubricant so good it actually isn't needed for anything but the fastest and most powerful jet engines. This new oil eliminates sludge. It stays clean on bearings and gears at tremendous pressures and temperatures.

Present oils are adequate for many of today's jet applications. But engines look to the new lubricant to solve problems that will exist at the extreme speeds and high fan oil temperatures already forecast for the future. The new oil holds great promise for application in jet-powered missiles for military use.

The silicone lubricant was perfected by changing the structure of the silicone molecule. The new oil forms a close-packed layer of protective lubrication. After passing every laboratory torture test with flying colors, the oil was tested in jet engines. There was a complete absence of sludge at the completion of the test.

This new development is typical of the kind of diversified, company-wide attention your problems get when you give them to AGT. This ability to put the right man to work on the job and to give him the right facilities is one more Westinghouse reason of helping you bring tomorrow's aircraft . . . One Step Closer. JUNE 1961

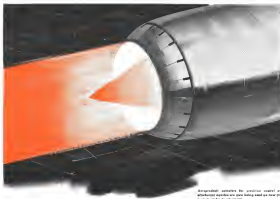
Dr. Gordon C. Gaiser, Westinghouse materials engineer, and AGT's George Townsend co-operated in developing the new silicone. Adapting it to jet engine use is an example of corporate co-operative effort available to you through your local Westinghouse AGT sales representative.

### THE WESTINGHOUSE AVIATION FAMILY

Jet Propellers • Airframe Systems Components • Wind Tunnels  
Airframe Electronics • Airport Lighting • Ground Electronics  
Aircraft Electrical Systems and Motors

YOU CAN BE SURE...IF IT'S  
**Westinghouse**





Aeroproducts achieves the positive control of aircraft systems as you bring out a new jet engine into development.

## Positive Control Instantly!

AEROPRODUCTS SYNCHRONIZED ACTUATORS PROVIDE POSITIVE  
SYNCHRONIZATION OF MULTIPLE HYDRAULIC CYLINDERS



General Motors engineering  
lands the way



Building for today... Designing for tomorrow  
**Aeroproducts**  
ALLISON DIVISION OF GENERAL MOTORS • PATTON, OHIO

Now, Aeroproducts mechanically synchronized hydraulic actuators assure precise positioning among the multiple actuating points of the afterburner nozzles.

Other models of Aeroproducts actuators combine synchronized metal with additional desirable features such as positive-acting, reflexibly positioning feature, and auxiliary power drive.

These actuators, in both hydraulic and pneumatic versions, are applicable to all high-ambient temperature environments, including jet engine thrust reversers, flaps, and spoiler surfaces on guided missiles.

If you're on a team designing a new airplane or powerplant, you'll find Aeroproducts ready to meet your most detailed specifications—for turbo-propellers, other propellers requiring high horsepower absorption, actuators, air-driven generators and hydraulic pumps, and other aircraft components now in the development stage.

## NEW AVIATION PRODUCTS



### New Pumps and Missile Pumps

Seven 1700 microfit-type pumps for planes and missiles operate efficiently with motor up to 16,000 rpm. The units require, and require no gear train or gear head motor.

Smallest pump in the series has a 0.0017-in. in displacement per revolution and the largest has 0.0257-in. in displacement. Smallest unit weighs 1 lb 32 oz with motor and measures 51 x 24 x 7 in. It pumps 55 gph at 65 psi of MIL-E-10500 liquid.

Extron Industries, 100 Skiff St., Houston 14, Conn.



### New Amplifiers for Aircraft

Two new amplifiers for aircraft cockpit and sales are now being developed for medium and medium applications.

AA-250 audio amplifier has provisions for two inputs selected a minimum of 30 db. A third input suitable for call output is also provided. Unit will accept 8 mV audio input with 25% harmonic distortion. Frequency response is and be flat from 300 to 6,300 cycles.

Equipment is used by the 1171-400 cycle and 25% d.c. voltage input operation. Internal power supply use of 14 v d.c. motor is separate transformer for high voltage supply. AA-208 weighs 5 lb 7 oz including brackets, and is contained in a welded aluminum box 6 1/4 x 4 1/4 in. List price is \$155.

AA-425 electronic amplifier is a dual

## McGraw-Hill Mailing Lists Will Help You

- How-to-get your advertising • Greater coverage
- Get leads for your company
- Get replies about your product or service
- Get paid geographical or functional groups
- Get leads
- Build up your business
- Add better business

Read Mail is a necessary medium in a well-organized business. These Advertising Agencies

offer 100 million copies of the top leading publications in all the fields covered by the McGraw-Hill publications, under 100 million copies. These are the most available sources for you can get. But they are available to only the McGraw-Hill agencies. This is a list of 1000 sources from the McGraw-Hill agencies.

How and where, providing complete and complete information. Read Mail agencies are a complete service. This offering allows a person to reach customers on the McGraw-Hill agencies.

For complete information about our service, call us in the company or write for our copy of the McGraw-Hill and McGraw-Hill agencies.



Direct Mail Division, McGraw-Hill Publishing Co., Inc.  
1221 Ave. of the Americas, N. Y. 10 10 1

Please forward me the copy of the McGraw-Hill "McGraw-Hill Direct Mail Agencies".

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

## AERODYNAMICISTS

★ New talent and equipment projects are growing an expert demand for aerodynamicists at Northrop Aircraft, Inc., America's best company in the total development, design and production of aircraft and aircraft systems.

★ If your training and experience qualify, you fit in with these challenging assignments, please telephone or write us.

Mr. Robert Hanger  
Manager of Engineering  
Infrared Division  
Northrop Aircraft, Inc.  
Hawthorne, California

★ Express free Los Angeles interview will be arranged for qualified applicants.

**NORTHROP AIRCRAFT**  
INCORPORATED  
HAWTHORNE, CALIFORNIA

COMPONENT-PRODUCT  
Qualification & Research

## TESTING

For Industry and Government Agencies

One of the Nation's Largest and  
Most Advanced Component Testing  
Laboratories Available to  
Component Qualification and  
Acceptance Testing in 1000 Tests

TEST EQUIPMENT

REGISTERED AND CUSTOM BUILT

INLAND  
TESTING LABORATORIES

101 Murray Avenue, Chicago 30, Ill.

20 Years in Service

## PRESSURIZE ELECTRONIC EQUIPMENT

with  
**Eastern  
UNITS**

The extensive line of Eastern Pressure-Unit for surface electronic equipment, encompasses a broad range of requirements, and meets appropriate government standards and meets appropriate government standards. Units can be modified to meet your specific requirements. These modifications usually are: 1) Different components, 2) Change size of unit, 3) Different components, 4) Different mounting arrangements, 5) Different mounting arrangements. Eastern welcomes the opportunity to discuss and quote on your particular application problem.

### MODEL E-10-100 TYPE 102

- Maximum in system pressure of 27 P.S.I.A.
- Motor is 1/2 HP—1000 R.P.M., 200 V., 3 PH.
- Current draw is 7 amperes/phase maximum under normal operating conditions
- Oil operates continuously
- Weight is 450 lbs. maximum



### MODEL E-10-150 TYPE 103

- Maximum in system pressure is system pressure of 27 P.S.I.A.
- Motor is 1/2 HP—1000 R.P.M., 27 volts A.C.—115 V.
- Current draw is 2.8 amperes/phase maximum under normal operating conditions
- Oil is 1000 operating hours
- Weight is 450 lbs. maximum



### MODEL E-10-150 TYPE 103

- Maximum in system pressure is system pressure of 27 P.S.I.A.
- Motor is 1/2 HP—1000 R.P.M., 27 volts A.C.—115 V.
- Current draw is 2.8 amperes/phase maximum under normal operating conditions
- Oil is 1000 operating hours
- Weight is 450 lbs. maximum



### MODEL E-10-300 TYPE 101

- Maximum in system pressure of 27 P.S.I.A.
- Motor is 1/2 HP—1000 R.P.M., 27 volts A.C.—115 V.
- Current draw is 2.8 amperes/phase maximum under normal operating conditions
- Oil is 1000 operating hours
- Weight is 450 lbs. maximum



### MODEL E-10-300 TYPE 103

- Maximum in system pressure of 27 P.S.I.A.
- Motor is 1/2 HP—1000 R.P.M., 27 volts A.C.—115 V.
- Current draw is 2.8 amperes/phase maximum under normal operating conditions
- Oil is 1000 operating hours
- Weight is 450 lbs. maximum



**Eastern  
INDUSTRIES, INC.**  
1000 W. 10th St.  
Grand Rapids, MI, 49506

COMPLETE  
AVIATION  
CATALOG #330-P  
ON REQUEST.

Channel used for use where steering selector switches are to be mounted overhead to the cockpit or on potential control panel.

It has provisions for eight individual outputs and crew telephone service. Any combination of outputs and telephone can be handled by pilot or copilot without affecting headset volume of the other. Included, even allows for passing the motion amplifier to a crew of three.

AL-125 is contained in a folded aluminum case 14x14x14 in. Weight is 1 lb. 2 oz. List price is \$175.  
Aviation Accessories, P.O. Box 4173,  
1605 North Mead, Fort Worth 6,  
Tex.



### Jeep Garryall Hauls 2,000 Lb.

New Jeep Garryall, capable of hauling 2,000 lb. of armor, explosives, freight and loaded on a low vehicle, has removable sides to permit easy back-loading. The new one developed from a standard Jeep Willys truck chassis. What has been added from 30 in. to 96 in.

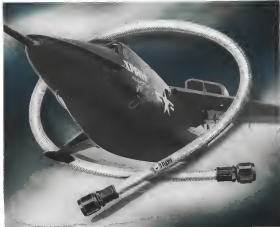
United Air Lines participated in the design and has placed 10 of the vehicles in service at seven cities.  
R. W. Allen & Co., San Carlos, Calif.

### Transistors in Amplifier

Transistorized booster amplifier, designed to meet military and civil plane requirements, operates directly from the 28 V. d.c. source required to drive motor. This means that the only weight added is the 14-oz. amplifier unit.

Model 1322 provides output of 10 w from a 1-w source. Input and output impedance are both 15 ohms. The quiescent response is flat within 1 db from 300 to 5,000 cycles. It is isolated. Fused circuit boards are used to provide long life. Unit measures 5x4x3 1/2 in.

Low, Inc., LosCal Division, 3471  
S. Brady Dr., Santa Monica, Calif.



## Weight-saving 450°F FLUOROFLEX-T "plumbing" in the MARTIN SeaMaster and its 4 engines

The world's first multi-jet attack seaplane uses the world's first Teflon-composed hose.

Fluoroflex®-T E2880 hose assemblies are used to convey fuel and oil, and as vent lines in the sleek SeaMaster... and are on its four powerful turbojet engines too. All in all, they add up to a sizable saving in weight over other hose types.

Fluoroflex-T lightweight, corrosion-resistant hoses are made with Teflon® compounded tube, 304 stainless steel braid, and blowout-proof fittings. Their flexibility stays the same from -200°F to +450°F... indefinitely.

IL-3800 assemblies are Service approved for synthetic fuels, oils. You'll be hearing about them in more and more engines, airplanes and missiles, where they solve high temperature operating problems. For more data, ask for BuAeros FH-2.

Fluoroflex is a Registered trademark made under the patents of the DuPont Chemical Company. Teflon is the DuPont trademark used for its tetrafluoroethylene resin.

**RESISTOFLEX**  
CORPORATION

Indiville 9, N. 2, • Western Division, Burbank, Calif.

Over 250 years of service to key industries

**A.B.**

Fluoroflex-T special back-up rings—another Resistoflex product from DuPont Chemical Company—are also in the SeaMaster, contributing to the reliable performance of hydraulic control circuits.

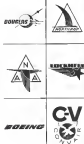
# Leading Aircraft

Manufacturers

use



aluminum tooling plate



Investigate...



**RED SEAL METALS CO.**  
10035 BURTIS STREET Dept. A  
SOUTH GATE, CALIFORNIA  
LOrain 6-5105

## AVIATION SAFETY

CAR Report on Business Lodestar Crash

### One-Engine Procedure Not Used

#### THE ACCIDENT

A Lockheed Model 1576 Lodestar, N 1571H, owned by John Fox publisher of the Boston Post, crashed into water south end of Gloucester, Mass., Nov. 3, 1954, at approximately 1942. Of the five persons on board the co-pilot was killed (the pilot seriously injured), and the three passengers received minor injuries. The aircraft was destroyed by impact and fire.

#### HISTORY OF THE AIRCRAFT

At approximately 1945, Nov. 5, 1954, N 1571H departed La Guardia Airport, New York, on a VFR (Visual Flight Rules) flight to Long Beach, California. The crew consisted of Capt. John H. MacIntosh and Co-Pilot William H. Wells. The passengers were Robert W. Madge, Raymond J. Wallace, Louis Victor Phillips, and Arthur C. Viktor, an electrical engineer. Climbing to an altitude of 5300 feet MSL, 1000 ft above the flight path toward Boston. Approximately 12 miles southeast of Westport, Mass., the right engine became very rough and lost power. The captain was unable to correct this condition and later indicated the right propeller when in the vicinity of Weymouth Cove. A side right turn was made from a southerly to a westerly heading toward Boston Field. Within 1000 feet Capt. MacIntosh then established with Boston Field and the flight was cleared for a straight-in approach to Runway 11.

The aircraft descended to 2300 feet MSL during the turn and thereafter continued descending on a southerly heading until it struck the water and crashed. No one seriously injured and no one seriously injured. The Boston Field, 1950, controller was stationed directly at 4500 feet, indicating 15 miles plus temperature 40 degrees, day plus 12, wind 100 knots and 10 ft. The weather at the time of departure was: Calm sea, scattered, visibility 15 miles plus 1000 ft, overcast, clouds with scattered clouds.

#### INVESTIGATION

The accident occurred approximately 9 miles southeast of Gloucester, Mass., and approximately 12 miles south southeast of Boston, Field.

When N 1571H struck the top of the trees it was on a westerly heading and on a descending right wing low attitude. Initial ground contact was at an elevation of 700 feet MSL and about 180 feet from the first trees struck. In the aircraft, the right wing hit first, then the right engine, nose of the aircraft and left engine followed. In a 1/4-second rotation of the aircraft to the right and a short final roll.

THE BOSTON FIELD controller was Captain MacIntosh and was based on the 11th floor of the

The crew members and one passenger were thrown out of the aircraft. The other two passengers, with the help of the passengers who had been thrown out, were found to be in the vicinity of a small airplane out in order to leave the trees. While on the ground, Capt. MacIntosh advised the airline photographer to the airport to observe the flight operation. Mr. Madge, crew, forward first and second class and the aircraft was at 3:50 feet MSL on a heading of approximately 65 degrees with an indicated speed of 150 mph. The engine was at 1500 rpm and the aircraft was in a steep climb with some left engine action.

Shortly before the engine difficulty began Mr. Wallace, seat forward, took the seat out, and walked while Co-Pilot Wells flew the aircraft.

When the engine roughness developed, Capt. MacIntosh, who was there at the time, immediately went forward and took the left seat and continued the aircraft and Mr. Wallace returned to the cabin. The right propeller was indicated after efforts to smooth the engine failed. Left engine and propeller controls were advanced to 31 inches manifold pressure and 3100 rpm with full rich mixture and no carburetor heat. Small amounts of engine and propeller controls were made on the opposite engine during the descending climb, from the left engine was to 36.75 inches manifold pressure and 3200 rpm. The last advance was made at 2300 feet MSL, but it gave an immediate response right performance. Capt. MacIntosh notified in the sequence of events.

Mr. Madge testified that he had moved to a position between the two and stated that the heading on the descending climb was 300 degrees and that the aircraft was at an altitude of 2300 feet descending at a rate of 200 to 300 feet per minute. The indicated pressure was 31 inches and the speed was 140 mph. At this time the crew of Weymouth was a few miles to the right. The co-pilot stated upon the impression of Mr. Madge and tried to use 1000 rpm (indicated) direction faster in the horizontal low frequency range. The crew was also advised of a field (head) field but beyond the airport. Capt. MacIntosh agreed to the suggestion.

When Mr. Madge, while on altitude of 1900 feet (250 feet above the ground) and an indicated speed of 95 mph he "saw" the engine and took a controlled landing, the engine was in a steep climb.

Both engines were low down the airframe and the aircraft was in a steep climb. During descent, although in a steep climb, there was evidence of a small final roll to the left engine. Sections of the right wing were found scattered around the main wreckage area. From the findings

## WESTERN GEAR



The design and manufacture of gears, gear drives and specialized equipment for aircraft use is a major activity at Western Gear. Since the first days of mechanical flight, Western Gear designers and engineers have played an increasingly important part in the production of components for successful or satisfactory operation of aircraft.

Virtually every major military or commercial aircraft today utilizes one or more Western Gear units. We are proud to be known as an important supplier to practically every major aircraft manufacturer. Our staff of engineers and designers are intimately acquainted with experts in the field of aircraft mechanical power transmission.

Our plant facilities are unexcelled and we are equipped for all types of machining and manufacturing operations, including experience with such new metals as titanium.

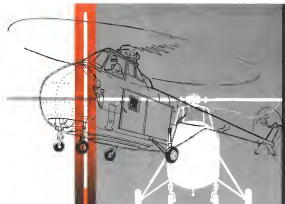
- a Airborne cable drive type belt, hydraulic or electric drive. Width 1.25 feet of cable, belt and covers 500 pounds at 50 feet per minute.
- b Cable drive type actuator, operating capacity 25" at 75" cable. Minimum cable pull 6500 lbs. Variable speeds available. Hydraulic motor powered. Direction, reversible.
- c Turbine powered auxiliary power unit, one of the latest types of turbine powered drives produced by Western Gear engineers. Unit drives provide noise reduction with integral accessory drive pulleys.
- d Gearmotor drive mounts on gas turbine driving two generators for auxiliary power supply. Utilizes oil-cooled pressure lubrication system.
- e Horizontal distributor actuator unit, AC and DC power providing three speeds for manual, autopilot and cruise control.
- f Rotary actuator, one of hundreds of basic designs. Unit actuated powered by both hydraulic and electric motors.
- g Radar equipment, typical example of Western Gear precision work made specifically for radar equipment.
- h Free gear precision ground, designed and produced for electronics, aviation and rocketry.
- i Starter drive, one of our prime type starter drives developed to reduce airborne equipment weight.
- j Accessory drive gear box, fits into in conjunction with starter shaft for increasing starting power to engine.

Sixty-six years of experience in the production of gears and speed machinery, whether prototype or production item, can be available to you in the solution of your problem. This store of knowledge is available for immediate help without obligation. Feel free to call on us at any time for information. Address inquiries to Executive Office, P.O. Box 182, Lynwood, California.

"The difference is reliability." - *News 1958*

**WESTERN GEAR**  
PACIFIC-WESTERN PRODUCTS [1971] [1972] [1973]

MAINTAINED IN LATEST PRACTICE - FOLLOWING FROM PRACTICE GROUPS, BOTTLE AND HISTORY - REPRESENTATION IN INDUSTRIAL DESIGN



**COOL CLIME!**



Arctic or Tropical... Indiana or Indonesia—the Hottest are flying every hour... and flying cool with Harrison on the job! On long hauls or short hops... on every type of rugged Veejet assignment, Harrison oil coolers are keeping transmission and engine temperatures at just the right levels. What's more, Harrison oil coolers are designed to save space and weight... and feature fast quick take-out and heavy cargo loading. With its unmatched research facilities, Harrison is always looking for new ways to make aircraft heat exchangers lighter, more dependable, more durable!

If you have a cooling problem, look to Harrison for the answer!

HARRISON RADIVAC DIVISION, GENERAL MOTORS CORP., LANSING, M.I.

TEMPERATURES  
MADE  
TO  
ORDER

**HARRISON**

#### • SAFETY

and right wing. All services tended that there was no fire until after ground impact. Careful examination of the structure revealed no evidence of fire in flight nor failure or malfunction of controls prior to the impact.

Disassembly and examination of the two propellers revealed that the approximate blade angles of the left propeller were 15 degrees and the right propeller blade angles were 50 degrees, the latter being near the full feathered position. There were no indications of mechanical failure or malfunctioning of the two propellers or their control assemblies.

Disassembly of the right engine revealed that the two three-bladed propellers and the cooling surfaces of the crank case were severely pitted and heated from corrosion and charring of the crankcase. Stiffens and other elements of the main bearing were mutilated. The power section was severely damaged with all pistons either lodged in the back of the cylinder or broken up and found in the power section.

Disassembly of the left engine revealed evidence that the cylinder pistons, and valves had been exposed to severe oxidant temperatures. No 3 cylinder exhaust valves remained, the pistons and bolts were missing and the heat valve stem and seat valve spring gave evidence of excessive opening temperatures.

An oil leak of the exhaust system was also observed less water in the one for the left engine. Plates and mechanisms which operated the engine stated it had been removed in an underwater test for left engine inoperative. The full heat test of the left exhaust system revealed a second fuel flow. Disassembly of the left exhaust system (AVC) (aircraft engine control) revealed that the needle was extracted beyond its normal position causing a leak condition. A slight melting of the solder on top of the AVC bellows was noted.

The aircraft and engine logs were destroyed by the fire. The engine engine installed an Airframe date of N 9311H were not supplied with logs when this was produced in 1970. The trace record of base on the engine was verified in accordance and cannot be determined. The repairs were limited to new line since installed, after a partial overhaul and inspection was made following this purchase. Since then the left and right engines had 479 and 170 hours, respectively, at the time of the accident.

The gross weight of N 9311H at takeoff has been computed at 17,979 lb, which is 150 lb under the maximum allowable gross weight of 18,129 lb. Fuel consumed during the flight to Glenview reduced the gross weight approximately 500 lb.

Capt. McKersie had been approximately four hours in flight on the subject aircraft and was seen in flight as recovered. His estimated flight time on the aircraft was about 200 hours. He stated he did the ferry flight in command of N 9311H that day had simulated engine-out flight on several occasions. He stated also reflects that he was ferry pilot or co-pilot on Lockheed aircraft during numerous test flights since the North Vietnam War World War II. It was verified that Capt. McKersie had two short periods of employment as a co-

## THE WORLD'S LARGEST PRODUCER OF READY - TO - INSTALL POWER PACKAGES FOR AIRPLANES INVITES YOU TO ENJOY YOUR WORK AND YOUR LIFE IN beautiful SOUTHERN CALIFORNIA

We believe we can offer you an opportunity to improve your position in the business world—and improve your way of life here at Rohr Aircraft Corporation in beautiful, temperate, exciting Southern California. To strengthen our personnel in various departments, Rohr has a real opportunity for you if you are skilled as an — **ENGINEER** (Aircraft Design or Structures) **LOFTSMAN** **JOB A FIXTURE BUILDER** **TOOL PLANNER** **TOOL DESIGNER**

**ROHR**  
AIRCRAFT CORPORATION

Write for complete details and we will answer immediately.  
Mr. Mark DeWitt, Personnel Department 16  
Rohr Aircraft Corporation  
Cala Vista, California

9 miles south of San Diego on easy San Diego Freeway

**\$ave**  
costly material and  
machining time by  
using Edgewater  
rolled steel  
rings

Cross-section designs are accurately formed during the rolling of Edgewater welded steel rings, to start clearly very little subsequent machining is needed. The uniform manufacturing acid, and stress treatment. Dimensions, 3 inches to 120 inches.

Write for descriptive booklet.

**EDGEWATER STEEL COMPANY**  
HASTINGS 16, IA

**Twist Wire**  
**3 Times Faster**  
with



**ROBINSON**  
**WIRE TWISTERS**

Split second wheeling action twists wire 3 strands in 2000 required for one by long slow method. Saves as much as \$100 per engine assembled.

3-Tool-on-1! Flares... Cuts... Twisters... Side cutting... Permanent bronze bearing... Jaws lock on wire, don't slip off!

Used throughout the world for all wire assembly and construction.

6 Standard, w/ 1200 \$25.00  
12" Standard, w/ 16 in. \$30.00

Unconditional Guaranteed Work for Detail BALPH C. ROBINSON CO., Box 4443, North Sacramento 16, Calif.



A precision ball joint component designed & developed by Skyline

**SKYLINE**

PRECISION SHEET METAL & WELDING PARTS  
COMBINE ENGINEERING SERVICE  
A.F. BARNES DUCT WELDING & OTHER  
WELDING PHASES

ELECTRONIC PARTS AND EQUIPMENT  
AIRCRAFT PLASTIC COVERING  
BRIGHT AND COMMERCIAL EQUIPMENT  
COOKING SERVICE EQUIPMENT

**SKYLINE INDUSTRIES INC.**

1001-1002 1st Ave. N. New York, N.Y.

ARE YOU GOING NUTS  
OVER YOUR  
BOLT  
PROBLEM?



You don't need a magic lamp...  
...you need AIRCRAFT BOLT  
CORPORATION!

Write for Complete Descriptive Catalog

**AIRCRAFT BOLT CORPORATION**

Specialists in manufacturing  
precision aircraft bolts and nuts

701 W. Hursey Blvd., El Monte, Calif.

#### SAFETY

pilot on DC-3 equipment before his employment in the 1st Lockheed co-pilot.

#### ANALYSIS

The Lockheed Aircraft Corp. operating instructions for Lockheed state under the heading "Single-Engine Emergency Operation." In the event of failure of one engine in climb, cruise, or descent, there is sufficient time for maximum power from the operating engine unless the airport has decreased by less than approximately 700 ft.

"On set the engine control in the auto-rot position, for propellers to give 2,500 rpm, and adjust the throttle to give a normal pressure ranging from 40.0 inches at sea level to 37.0 inches at 5,000 feet...."

"(b) Feather the propeller propellers and cut the carburetor mixture control as applicable.

"(c) Set the carburetor heat adjustment to cold when using carburetor heat.

"(d) Draw the engine with rubber tub control.

"(e) Turn fuel system engine selector valve to operating engine only.

"(f) Direct mixture for vacuum pump and two and half.

"(g) Reduce the manifold pressure to

give a low power output as is consistent with safe operation."

The same instruction manual under "Control Flight Data" states that at 17,500 ft, the single-engine ceiling is 16,500 feet and the indicated speed for maximum rate of climb, one engine, one level, is 117 mph.

Further it is an accepted practice for a pilot with an engine out to immediately cut manifold pressure to the minimum and single-engine flight with maximum loss of altitude is considered. For or rather he reduced to optimum altitude per horsepower.

As indicated to be the pilot, and an observing passenger, power was only maintained by small increments during the entire loss of altitude and speed. Even the last increase immediately prior to the crash was only a power setting consistently below the critical setting required for single-engine operation as the Lockheed manual. Had the airport technique been used it is believed the accident could have been flown to an available airport.

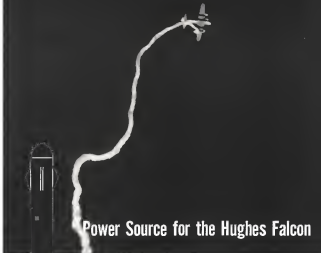
It is apparent that there was ample opportunity for the captain to have become thoroughly familiar with current single-engine procedure as the aircraft.

The condition of the right engine was shown changing surface indicated some fault



EMPTY LAUNCHER

This multi-level launcher is for deployment use, probably with the Gemini Tundra and aircraft carrier. Navy's Bureau of Ordnance sponsored the design and manufacturer of the launcher by the W. L. Mason Corp. This firm, shown directly, support the launch and launch, launcher is selected by non-mechanical techniques developed from standard Navy command-and-control methods.



## Power Source for the Hughes Falcon

... a *Thiokol* solid propellant rocket

The Falcon, designed and built by Hughes Aircraft for the United States Air Force, is one of the most advanced solid propellant rockets in production. It is launched from unattended planes and is capable of pursuing and destroying enemy bombers, taking evasive action.

The power required to launch and guide the Falcon from an interceptor is supplied by a "Thiokol" solid propellant rocket motor.

Development of the Falcon motor is the result of close teamwork between Hughes Aircraft and the Armed Services. Thiokol is also engaged in other programs that provide our Armed Services with improved solid propellant rockets adapted to specific operational requirements.

SOLID PROPELLANT PROPELLANTS AND POWER UNITS FOR:  
ALL TYPES OF ROCKETS GAS GENERATORS  
BURNER UNITS AIRCRAFT POWER PLANTS  
DIRECT IGNITION POWER PLANTS

*Thiokol Chemical Corporation*

ASTORIA, OREGON • PISCATAWAY, NEW JERSEY • ROCKFORD, ILL.  
780 NORTH CLINTON AVENUE • TRENTON 7, NEW JERSEY  
Dixon Division, Elkhart, Ind. • Elkhart Division, Elkhart, Ind. • Longview Division, Marshall, Tex.

ENGINEERS AND CHEMISTS  
Thiokol is a member of Thiokol's staff of designers and manufacturing specialists who select materials and manufacturing methods for the rocket field.

# ENGINEERS AND SCIENTISTS

You'll find at  
**CONVAIR**  
A DIVISION OF GENERAL DYNAMICS CORPORATION

## ENGINEERING FOR THE FUTURE

### CAREER OPPORTUNITIES EXIST IN:

#### AERODYNAMICS

Aero-Analysis  
Performance

Theoretical Aerodynamics  
Experimental Aerodynamics

#### AEROPHYSICS

Stability and Automatic Control  
Aero-Electronics

Armament Analysis  
Electronic Coupling

#### PROPULSION

Propulsion Research  
Environmental Controls Systems Development

#### NUCLEAR PHYSICS

Theoretical Reactor Physics  
Experimental Reactor Physics

#### STRUCTURES ENGINEERING FOR AIRCRAFT

Stress Analysis  
Structural Research

Flutter and Dynamics  
Structural Loads

#### DESIGN FOR AIRCRAFT AND NUCLEAR APPLICATION

Airframe Structures  
Thermodynamics  
Mechanisms  
Power Plant Installations

Electrical  
Electronics  
Equipment Design

#### ENGINEERING TEST

Flight Test Instrumentation  
Data Reduction  
Fluid Dynamics—Electronic, Electrical—Structural

It is required that applicants for these positions have formal education in Aeronautical, Mechanical, Civil or Electrical Engineering, Physics or Mathematics—or professional experience in one of the fields above.

At CONVAIR you have an excellent opportunity to do graduate work-in place or at evening college. CONVAIR offers liberal tuition allowances, paid master's, doctoral fees, insurance and retirement programs.

Send Resume to M. L. TAYLOR  
CONVAIR, Engineering Personnel Dept. NN  
FORT WORTH, TEXAS

**CONVAIR**  
A DIVISION OF GENERAL DYNAMICS CORPORATION  
FORT WORTH, TEXAS

### \* SAFETY

In the midlife of this jet at a time prior to purchase of the engine.

The condition of the left engine is indicated by dimensionally indicators that there was available to the pilot less than normal power in all settings. Although the left engine was not developing normal power for each power setting, it is believed that there was sufficient power remaining, so that flight could have been maintained had the pilot used accepted single-engine procedures.

Had the pilot made a different turn at the time of the engine failure the resultant shorter distance might have enabled the aircraft to have safely reached Huddell Field despite the suspected loss of altitude.

Although a thousand feet of altitude was apparently lost during the critical part of the emergency there was still sufficient time and altitude to enable correct single-engine performance. This was borne out in the fact that when the southeast landing was established the aircraft was still at 3,500 feet and descending at only 200-300 feet per minute. This rate of descent continued down to 200 feet above the ground at which time the intended steepen was only 95 mph.

### FINDINGS

On the basis of all available evidence the Board finds that:

1. The crew and the aircraft were properly notified.
2. There was no fire prior to impact.
3. Weather was not a factor in the accident.

4. A structural failure occurred in the power section of the right engine that soon caused loss of the right propeller.

5. Failure to attain single-engine performance resulted in loss of altitude.

6. Mechanical difficulties in the left engine reduced power but remained available power was sufficient to single-engine performance.

### PROBABLE CAUSE

The Board determines that the probable cause of the accident was that after failure of the right engine, accepted single-engine procedure was not followed, which resulted in the aircraft losing altitude and striking the ground.

By the Civil Aeronautics Board,  
Ron Raley  
Joseph P. Adams  
John Lee  
Clare Gentry  
Herman D. Dooley

## Israelis Planning Mach 1.5-4.5 Tunnel

Tel-Aviv—A highspeed wind tunnel is to be purchased by Technion, the Israel Institute of Technology at Haifa, for aerodynamic studies in its Department of Aeronautical Engineering.

Speed range of the tunnel will be from Mach 1.5 to 4.5. Highspeed photographic equipment will be utilized.

The Department is headed by Prof. Shalom Goldfarb, a well-known Israeli aerodynamicist.



Two Aerojet-General high-thrust, short-duration solid propellant rocket powerplants boost the Navy's famed REGULUS missile off on its mission.

Built by Chrysler-Vaughl, the REGULUS is one of a growing number of available missiles for defensive or offensive applications.

This booster was fabricated for REGULUS Proven reliability, predictability and low cost make it another example of Aerojet-General's unsurpassed experience in development and production of rocket powerplants.

Aerojet-General supplies liquid and solid propellant rocket powerplants, auxiliary power units, gas generators, or other associated equipment to a major part of America's missile program.

Since the first JATO was produced by Aerojet-General in 1943, the company has delivered over 350,000 JATO's and boosters ranging in thrust from 250 pounds to 350,000 pounds.

\* Solid and Liquid-Propellant Rocket Powerplants for Missile and Aircraft Applications. \* Aerojet-General Thrust Boosters (SBOCRA). \* Auxiliary Power Units and Gas Generators. \* Thermionics and Electronics. \* Guidance Systems. \* Engine Control and Monitoring. \* Data-Acquisition Programs. \* Airframe-Engineer Services for Test Facilities.

### AEROJET-GENERAL NEEDS

CHEMICAL ENGINEERS (CHEMISTS, SURFSCIENCE ENGINEERS), MECHANICAL ENGINEERS, PHYSICISTS AND AERONAUTICAL ENGINEERS

**Aerojet-General CORPORATION**

A SUBSIDIARY OF  
THE GENERAL TUBE & SHEET CO. COMPANY



AZUL, CALIFORNIA  
SACRAMENTO, CALIFORNIA

MORE POWER FOR AIR POWER



## ENGINEERS

**Creative  
Opportunities  
with  
Republic Aviation**

**PHOTO ACKNOWLEDGMENT:** Author gratefully acknowledges to two reviewers of this report their criticisms, helpful comments. To a staff on the ground at the school, thank you.

## Appendix

Figure 3 continued

Journal 1992

the search

**SYNOPSIS:** PROWSE, a novel program, finding modified and deleted files in a directory tree on a single platform, performs a walk over the target system's entire file system, and identifies files that have been modified or deleted. It is designed to be used by security analysts to identify files that have been modified or deleted on a system. It is designed to be used by security analysts to identify files that have been modified or deleted on a system. It is designed to be used by security analysts to identify files that have been modified or deleted on a system.

**FLUENT INSTRUMENTATION ENGINEER** handles all field work, trouble shooting, etc., in laboratory, process, control systems, including hardware for I/O cards and ladder logic or PLC's & graphics development.

[illegible][illegible]

**COMPUTER ENGINEER** To develop a computer code to design and calculate the bending of a beam in shear. Must have BS in degree program. Required: 1 year graduate work in

**HEAVY POWER PLANT ENGINEER** Must be able to read

Received 1999/05/10; revised 1999/07/20; accepted 1999/08/02. This work was supported by the National Natural Science Foundation of China (grant no. 49775001).

[illegible][illegible]

**EDWIN SIMONS ANALYSIS METHODS ENGINEER** 1983 to 2012  
in a combination of civil engineering, civil structural and mechanical design,  
structural and civil engineering, structural engineering, structural engineering,  
structural, civil and structural engineering

[illegible]

© 2005 Blackwell Publishing Ltd, *Journal of Internal Medicine* 258: 105–112

Assistant Chief Engineer  
LAWRENCE  
Mr. R. A. FORTIN

**PUBLIC AVIATION**  
FARMINGDALE, LONG ISLAND, NEW YORK

ANTED	SPARKPLUGS WANTED
-------	-------------------

1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 26

SALEM & ELECTRONICS SUPPLY  
11011-6 Ave. D Salem, N.J.

**C-67**  
What's the  
present state  
of...  
*If there is anything you want  
that other orders can supply  
OR... something else don't mention*

Advertisements in the  
**SEARCHLIGHT SECTION**

1000

## OUTSTANDING ENGINEERING OPPORTUNITY

Are you a specialist or a recent graduate proficient or untested in two or more of the following fields?

- Aero-Thermodynamics
- Internal Aerodynamics
- External Aerodynamics
- Ballistics
- Ram Jet and Turbo Jet Test and Performance
- Transonic and Supersonic Design and Test Operations
- Turbine and Compressor Design

Sherrard & Pincel, Inc. is engaged both nationally and internationally in design and consultation of advanced and unusual mechanical test facilities which require the theory and application of these special fields. The wide variety of our work, embracing the design and review of industrial development facilities, often challenging problems and provides excellent opportunity for individual development and advancement.

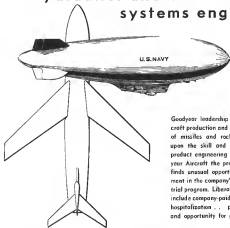
Starting salary and extent of responsibility are dependent upon individual ability and experience. Fringe benefits include an unusually attractive Employee Stock Plan which matches insurance features and provides for retirement, paid vacation, holidays and sick leave, overtime rates and an employees' club which offers interesting social and practical values. Two accredited universities offer opportunity for advanced study too.

Your letter of inquiry will receive prompt attention and reply. Please write to—

**SVERDRUP & PARCEL, Inc.**  
Consulting Engineers  
915 Olive St. St. Louis 1, Mo.



hydraulics and control  
systems engineers



Goodyear leadership is lighter-than-air: aircraft production and in the development of missiles and rockets is dependent upon the skill and resourcefulness of product engineering groups. At Goodyear Aircraft the professional engineer finds unusual opportunity for advancement in the company's diversified industrial program. Liberal employee benefits include company-paid life insurance and hospitalization . . . paid vacations . . . and opportunity for graduate study.



Goodyear Aircraft has immediate openings for graduate engineers in every field. Write today for an application form, or ask about openings in your classification.

C. G. Jones, Mgr.  
Sales (Personnel)

**GOOD YEAR**

GOODYEAR AIRCRAFT CORPORATION  
1110 MASSACHUSETTS ROAD, ARRON IS. OHIO

## RESEARCH

**ENGINEERS**

INERTIAL GUIDANCE AND WEAPONS FIRE CONTROL

- SYSTEMS
- COMPONENTS



**MIT**  
Instrumentation  
Laboratory

*Write*

MARTIN PHILLIPS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
INSTRUMENTATION LABORATORY  
65 Albany Street, CAMBRIDGE 38, MASS.

*Graduate Courses*

MAY BE TAKEN FOR ACADEMIC CREDIT

WHILE EARNING FULL PAY

**is YOUR FUTURE as promising  
as a HELICOPTER'S?**

We think the future of the helicopter is virtually unlimited. Why not make your future just as promising?

SIKORSKY, pioneer helicopter manufacturer, needs...

TEST ENGINEERS  
DESIGN ENGINEERS  
DEVELOPMENT ENGINEERS

to do important work in the fascinating and fast-growing helicopter field. Expanding military and commercial requirements are a challenge to skilled men—offer excellent opportunities to further your professional stature.

Engineers whose abilities or experience qualify them for these responsible positions will enjoy a well-rewarded career with a secure future and many benefits for themselves and their families.

Send a complete resume to R. L. Allen, Personnel Department

**SIKORSKY AIRCRAFT**

Bridgeport 1,

Connecticut

**A NEW ERA . . .**

In-flight refueling, pioneered by Flight Refueling, Inc., has created new and challenging opportunities for qualified engineers in the following categories:

AEROBATHMIST  
AIRCRAFT HYDRAULICS  
SPECIALIST  
AIRCRAFT ELECTRICAL  
SYSTEMS ENGINEER  
FUEL SYSTEMS ENGINEER  
AIRCRAFT STRUCTURES  
ENGINEER

Send your inquiry to:  
Hilco 3, One Eisenhower Square

*Flight Refueling, Inc.*  
INTERNATIONAL FLIGHT REFUELING SERVICE  
Baltimore 3, Maryland

**ADVANCE YOUR POSITION IN  
GUIDED MISSILE ELECTRONICS**

*Apply your wealth of engineering experience  
at RCA!*

**PROJECT ENGINEERING**

You will direct and coordinate the work of a group charged with developing complex systems. You'll administer programs which result in systems that meet military requirements. Your wide experience in equipment development and design, and sound management background will be fully utilized.

Project Engineering Fields include:

Radar • Data Handling and Transmission • Computers

**SYSTEMS ENGINEERING**

**Advanced Systems Analysis**—You will create from basic military requirements new guided missile systems which utilize the latest advances in electronics. Close contact is maintained with basic research developments at RCA and other research centers.

**Systems Development**—You will view systems as a whole in order to anticipate and solve problems. You'll develop design criteria for major components which insure operational reliability of overall systems. Your broad technical experience and thorough understanding of the systems approach will be applied.

**ENJOY ALL OF MANY REMARKABLE CAREER ADVANTAGES . . .**

Plenty and variety  
of education and experience in:

Mr. John E. Wolf  
Employment Manager, Eng. Div.  
Radio Corporation of America  
10 Rockefeller Plaza  
New York 20, New York



**RADIO CORPORATION of AMERICA**  
ENGINEERING PRODUCTS DIVISION







**YOUR No. 1 SOURCE  
FOR COMPLETE  
BELLOWS-ASSEMBLIES  
AND DEVICES**

## FULTON SYLPHON BELLOWS HEADQUARTERS, U.S.A.

You gain three important advantages when you consult Fulton Sylphon, originators of the metal bellows—1. Over 50 years experience in bellows engineering is focused on your problem. 2. Modern production facilities geared to good service. 3. Cost saving opportunities through the design and production of complete bellows assemblies.



**Robertshaw-Fulton**

CONSOLE COMPANY

FULTON SYLPHON DIVISION  
Knoxville 1, Tennessee

- 1. Please have a Bellows Engineer call me for an appointment
- 2. Send me Bellows Catalog if available

Name  Title

Company

Address

City  State



### WE'RE BEYOND INFORMATION

Our 32 page catalog shows basic bellows engineering, construction tables, inside available and other bellows data. Use like handy coupon for your free copy.

## AIR TRANSPORT Seaboard Plans Atlantic Cargo Schedule

By Gordon Gueley

New York—Seaboard & Western Airline plans to operate a scheduled service between the United States and Europe when its North Atlantic airship commences because effective in mid-August. The new flights will increase cargo competition among scheduled trans-Atlantic airlines, adding about 144,000 lb. a week to the total available airfreight capacity.

President Eisenhower approved Seaboard's five-year contract June 16 ending S & W's eight-year fight for a scheduled operation. His decision, made in line with recommendations submitted by Civil Aeronautics Board 13 months ago, cleared away the last of major international air transport cases involving action at the White House.

The certificate authorized Seaboard to carry cargo from New York, Philadelphia and Baltimore to New London and Ireland. Beyond Ireland, the airfreight line can fly to West Germany via London, the Netherlands and Belgium and to Switzerland with stops at France. The service will receive no government subsidy.

### 60-Day Wait

S & W must wait 60 days before it can inaugurate scheduled North Atlantic flights. The interim period will give five carriers that petitioned CAB's recommendations—TWA, Pan Am, Air Lines, Pan American World Airways, Trans World Airlines, Orient National Airlines and European-American Airlines—a chance to try and improve the route.

Last week spokesmen for the three major airlines made their comments. •TWA—“I don't know for a fact whether we'll seek a permit for more intensive. It's not possible opinion that the company's attitude now is that we're more interested in the Pacific and it's quite possible we'll let the trans-Atlantic decision go by the board.”

“I would think there's no doubt about TWA and Pan Am performing for recommendations.”

•Pan American—“It's been a blow, but now we'll probably wait and see whether they can carry it.”

•TWA—“We haven't decided what we will do.”

The 60-day interim period also will give the Board time to examine bilateral agreements with countries on

Seaboard's routes and to act on the airline's proposed plan for operating its new service.

S & W wants to start with six round trips a week between New York and Shannon, branching out from there to London, Amsterdam, Brussels and Frankfurt on one leg and to Paris and Zurich on the other.

Better flights can be inaugurated from Philadelphia and Baltimore. Sea board must open offices in the two cities and decide the frequencies needed.

### Nation's Prediction

On behalf of the new operator's future, President Eisenhower V. Nader said, “I predict considerable growth that we will increase our present volume by at least 100% during the first year.”

Seaboard plans to buy new transports for its airfreight fleet in the near future, and Nader indicated the order may go to Lockheed Aircraft Corp. for its new 104H Super Constellation. It now operates four 104H Super Cons-

on and six DC-4s. Maximum payload for each S & W Super Constellation is 17,000 lb. and 17,000 lb. for the DC-4s.

### Airfreight Pact

To work out a possible cooperative agreement, Nader set last week with American Airlines President John V. Hubbard. The British carrier operates the only other scheduled all-cargo service between the United States and Europe (AW Line S. 120).

Personally, I think Seaboard's certificate is a healthy sign. Hubbard and What if he lets us see Seaboard as a joint IATA (International Air Transport Association) and operate as a competitive partner.

Working together, we could develop a valuable tariff structure and strengthen the whole North Atlantic airfreight operation. We'll have a common interest. We'll be the only all-cargo carrier in IATA.

But if they stay out, all members will suffer open war and take action against Seaboard collectively. I certainly

## Why CAB Reversed Itself in Cargo Case

Washington, D. C.—Two major factors entered into Civil Aeronautics Board's decision last year to recommend a trans-Atlantic cargo certificate to Seaboard & Western Airlines, after ruling in 1959 that there was no need for the service. These were:

- Rapid equipment developments, including the DC-6 and Super Constellation, makes the cargo operation economically feasible while DC-4 cargo operations are not.
- Support of the Defense Department in favor of the cargo operation in the interim case.

The Board's text made these points:

“Advantages of the certified service naturally require the new carrier to exercise diligent effort and promotional and developmental ingenuity in the creation of new markets for its service and in the provision of new service advantages to promote current markets. In the case below, the existing certificated carriers will necessarily be engaged in similar efforts.”

One of the advantages of this competitive effort, we expect the rapid expansion of the trans-Atlantic air cargo market, resulting in an enormous new service and an increased net yield for the existing certificated carriers. Thus a new all-cargo service will help rather than hurt an existing United States trans-Atlantic carrier and will as we once thought the subsidy support supplied for these carriers.

We are convinced that the new trans-Atlantic cargo service has been authorized will derive its principal support from cargo potential as yet untapped in the certificated carriers and not from revenues derived from the certificated carriers.

... The basic contention is that the service and development of the cargo market is in such interest (PAA and TWA), of secondary or incidental concern as compared to their passenger service. So long as this is the case, the public interest requires that the United States be represented in this important field by a carrier that will have its primary interest focused in this development. Confession of a new carrier will give greater assurance of sustained developmental effort and operation of Atlantic services. For such a carrier's very existence depends on the operation, and therefore there is every incentive to maintain the service.”

# 3 REASONS WHY IT'S for Aircraft and



**IN CHARGE OF SYSTEMS DEVELOPMENT** at General Mills are Dr. Carl L. Kaber (left) who was a top man on German radar and V-2 interception and also spent five years at Wright Air Development Center, and Dr. Howard H. Dollar (right) who came to General Mills via Cal Tech, Topdown, Fairchild Guided Missile Division and W. L. Mueser Corp. Looking on is Dr. Clyde Bennett, director of Engineering Research and Development, a personnel figure in electronics because of his work for the Naval Bureau of Standards, Standard Research, General Mills, and the Department of Defense.

## 1. THE RIGHT PEOPLE

It takes a highly specialized kind of creative engineer to develop top-notch aircraft systems—guidance, navigation, bombing and fire control. At General Mills you get a complete staff of such specialists—men who have met and mastered problems just like those you are facing. In addition, our staff includes personnel trained in laboratory studies, prototype manufacturing and exacting performance testing. Top people in electronics, in mechanical research and in physics and chemistry research are also available for specific phases of any problem.

## 2. THE RIGHT EQUIPMENT

Our modern plants, with 400,000 sq. ft. of area, are completely equipped for exhaustive research, engineering and development work in addition to precision manufacturing. All types of operations in the manufacturing process, from raw materials to finished systems, can be carried out within our plants. The unusually high level of precision maintained often requires reworking of standard machine tools in our shops to maintain microscopic tolerances. All inspection and calibration work is done in dust-free, temperature-controlled rooms. Quality control is rigidly maintained through detailed inspection of all materials, manufactured parts and sub-assemblies.

**AMONG THE SPECIALIZED EQUIPMENT** in our plants are ultrasonic gas bubble machines, log engine-burner (above) testing land and seaplane for the V-4 homing rocket, modern equipment for precision assembly and inspection.



# General Mills Missile Systems...



COORDINATE  
CONVERTER



V-4 HOMING ROCKET

AUTOFAX MACHINE

HERE ARE SOME EXAMPLES of the precision electro-mechanical engineering and close-tolerance production services available to you at General Mills. The V-4 homing rocket permits pinpoint bombing from transoceanic distances; the Coordinate Converter links the



FLIGHT RECORDER



V-4 homing rocket with other elements of an aircraft's bombing system; the Flight Recorder maintains a complete flight record of velocity, acceleration and altitude; the Autofax Machine assembles electronic circuits automatically at high speed.

## 3. THE RIGHT EXPERIENCE

Besides manufacturing precision ordnance instruments since 1940, we have had broad experience in the development of aeronautical and industrial control systems. Our engineers have a first-hand understanding of the theoretical as well as the practical requirements of effective systems; we have developed several unique new weapons for the armed forces as well as feedback instrument systems for precision control of industrial processes and military operations. Other projects include highly complicated electronic and electro-mechanical airborne computing and control systems.

**READY TO SERVE YOU . . .**  
are complete facilities for electronic and electro-mechanical research, design, develop-

ment, production engineering and precision manufacturing in connection with...  
☐ aircraft systems ☐ industrial instrumentation and control ☐ specialized precision instrumentation ☐ navigation and missile control systems ☐ electro-mechanical computers ☐ remotely-controlled manipulators ☐ telemetering (radio and wire) ☐ fine-particle technology ☐ meteorological and high-altitude research. **WRITE TODAY** to Dept. AW-1, Mechanical Division of General Mills, 1620 Central Avenue, Minneapolis 18, Minn.

*Job opportunities available for creative engineers. Work closely with outstanding men on interesting projects.*

**MECHANICAL DIVISION OF General Mills, Inc.**

## TRANS-CANADA AIR LINES REPORTS:

# Traffic up 55%

in the first month of Viscount service on New York-Toronto route



### Wherever the Viscount flies...traffic figures rise!

This statement has been dramatically proved in actual service by enterprising airlines all over the world. One of the most recent proofs of the Viscount's prowess as a traffic builder comes from Trans-Canada Air Lines.

In their very first month of operation, TCA's latest figures show that their new turbo-prop Viscounts carried 55.5% more passengers than did their piston-engined aircraft the preceding month... although the April capacity was only 38-39% greater! And in the same period of time, the passenger load factor rose from 79% to 97%.

In the 800 million passenger miles that Vickers Viscounts have flown throughout the world, they have consistently demonstrated an ability to reduce operating costs and increase load factors and profits.

The passenger appeal of Vickers is unequalled in the annals of commercial aviation. They are faster, and have reduced flight times on major air routes by

as much as 30%. They are more comfortable. Remarkably free from vibration and engine noise, the Viscount permits travelers to converse, read, sleep with a new degree of ease and relaxation.

Behind the Viscount stands the great name and service organization of the Vickers Group—internationally famous in the makers of ships, industrial machinery, heavy tractors and precision equipment.

**VICKERS**  
**VISCOUNT**

built by VICKERS-ARMSTRONGS  
powered by ROLLS-ROYCE

VICKERS-ARMSTRONGS, LIMITED  
(Incorporated in England)

Credit Photo Representative: Christopher Clark, (2) Lockheed Photo: New York 26, N. Y.

wouldn't work to fight 15 inches."

Norden said his engine probably will join IATA and work side by side with its British counterpart.

"With the combined services of both engines, we can give passengers service to the shipping public," he said. "There's still a lot of work to be done on selling the idea of airfreight, and that needs cooperation."

On tanks, Norden reported Seaboard would push its theory of specific rates for certain commodities.

"Certain commodities can stand certain rates," he said. "If we can coordinate at different levels, returns on the higher-rated goods will make it possible for us to cover other commodities that otherwise would not move by air."

## Lockheed Offers New Airfreighter

Lockheed Aircraft Corp. is coming out with an all-cargo version of its 1049D Super Constellation. First order for the 51 Lockheed 1049H possibly will be placed by Seaboard & Western Airlines, only carrier to buy the 1049D airfreighter.

Other orders are expected from Silk Airways and Flying Tiger Line. Seaboard is the better prospect. It leased a 1049D from Seaboard during the first part of this year and indicated satisfaction with its performance.

### Low Operating Cost

In its 1049H sales campaign, Lockheed is making an attractive offer for cost-conscious airfreight carriers. "It will move more things with greater ease than any commercial aircraft now available," the builder claims, "and it will do the job at the lowest cost per hour in the world."

The company quotes three direct operating costs for trans-Atlantic flights with a five-man crew, full engine water configuration, a three-hour load service and average yearly winds of 24 mph.

• New York-Shannon, 9.1 cents per hour with a 25,300 lb. payload.

• New York-Paris, 10.47 cents per hour with a 25,600 lb. payload.

Maximum payload for the 1049H will be 36,625 lb. Range with typical and no fuel reserve is quoted at 5,500 miles and top level flight speed at 365 mph, equal to 1049C performance.

### Greater Takeoff Weight

Greatest difference between the 1049C and the 1049D will be an amazingly stiffened wing, allowing a higher gross takeoff weight. The 1049H will go up to 117,200 lb., while the 1049C's limit is 115,400 lb.

It will be powered by four 1,738-hp Wright Turbo Compound 917TC18-D4F piston engines. Pratt & Whitney is equipped with four Wright 917TC18-D4Fs, also rated at 1,750 hp. The D4F delivers 1,700 hp in low thrust mode, compared with 1,640 hp for the D4C.

Like the 1049D Super Constellation, the 1049H will convert to passenger configuration. But the new transport will carry only 52 aircraft passengers, compared with a 109 maximum for the 1049D. Seaboard figures conversion time for the earlier freighter at 24 hours. Other features of both the 1049H and the 1049D include:

- All-magnesium floor that can carry loads of 1,300 lb. per square foot or 100 lb. per square foot.
- Floor tie-downs arranged in a grid pattern. These permits for loading loads up to 4,000 lb. in any direction, with no restriction on the angle of pull.
- Optional equipment such as weather surveillance radar and wingtip fuel tanks.

With its new certificate for scheduled trans-Atlantic cargo flights, Seaboard & Western Airlines will be able to attract General backing for expansion.

### Customer Testimonial

"The Super Constellation is the best ever, several long-haul airfreighters now available," says Arthur V. Norden, Seaboard's executive vice president. "The Douglas DC-6A is no improvement to the 1049D only on short hauls."

For non-scheduled North Atlantic flights, Seaboard increased the maximum payload of its four Lockheed transports 107,200 lb. and operated them at a load-even load factor of 57%. Direct operating cost was approximately 10 cents per hour-mile.

Despite its confidence in Super Constellation design, Seaboard looks at both the 1049D and the 1049H as interim transports.

"Our craft replace will carry at least 30 tons at once," says Norden, "and it will have very extensive and multi-cargo doors that will be strong or truck-bed height."

"Cargo doors on the Super Constellation are too high. It takes an inch to land seven tons on the 1049D. At present, get bigger, that ground time will kill us. A freighter like the Super Constellation with a 10-ton payload would take more than seven hours to load."



## Tiptanks Give Turboprop YC-121F 4,000-Mi. Range

At Fort's turboprop YC-121F, whose 400-mph. speed is billed as world's fastest for a prop-driven transport, has a range of 4,000 mi. with 6,000-gal. fuel tanks in the flight log. Lockheed says the combination cargo personnel-evacuation carrier can carry 10 tons load across the U. S. in under 6 hr. USAF is getting two of the ships and Navy two (JTV 2). Noctules of the four 1,700-hp P&W T-54 engines are mounted high on wing.

## German Bilateral Is Delayed As State Studies Criticisms

Washington, D. C.—Airline and commercial contacts have caused a State Department reconsideration of the proposed bilateral air transport agreement actively negotiated with West Germany (AW June 20, p. 10).

State Department delayed a final decision last week on whether to approve the agreement while the Civil Aeronautics Board heard arguments from the airlines which would be affected. The carrier had complained that it had been sufficiently restricted in the negotiations to proposed rights for a German carrier to Latin America.

At the conclusion of a series of transport hearings called to examine the bilateral trade, passport and its method of negotiation, the Senate Committee and Foreign Commerce Committee urged the Senate, State Department and CAB to re-examine the proposal before signing it.

### State Position

CAB will advise the State Department on the economic aspects of the proposal, then State will make the decision whether or not to sign it.

The Senate committee heard testimony in open sessions from five airlines, CAB and the State Department before going into closed sessions to hear testimony from the airlines which the State advised to disclose in public hearings because of their sensitive nature.

In open session, Deputy Assistant Secretary of State Theodore V. Kuhn stated that the granting of rights to German airlines in Latin America set a precedent that would have to be followed with all foreign airlines. He said that "only those who have what we want and need should obtain comparable benefits."

### May Cause Restrictions

In reference to airline recommendations from Germany and that the carrier had complained the imposition of obtaining the rights also now have in Germany, plus rights to operate beyond German ports. The transport authority to operate into Germany now held by Pan American World Airways and Trans World Airways expires next year.

Kuhn said the committee that "the exclusion of the German and other European carriers from participation in the United States-Brazil American carrier market case only lead to the argument of severe restrictions on the bilateral operating rights which United States carriers enjoy, and beyond Europe now operating. Such a course of

action would be a serious blow to the economic well-being of the United States international airline industry and to the welfare of the country."

Kuhn advised that Henry Helms, Assistant Secretary of State for Latin American Affairs, disagreed with the official State Department position on the German bilateral.

China clearly told the committee that to meet international routes, U. S. carriers must stop in some country beyond London or Paris, and that "our international service is threatened."

### Pan Am's Angerment

In explaining the large number of protest proposals for service by American carriers in Germany, Germany and that until a series of local service from inside Germany contributes a more important point, it is to the advantage of U. S. international airlines to serve the points indicated in the proposed bilateral agreement.

Pan American, only U. S. carrier serving both Germany and South America, told the committee that the establishment of its rights to serve Germany, and to fly beyond that country in intercontinental service to the carrier and the United States. Pan Am President Ronald B. Adams said that Pan Am has objections to trading the five American cities—New York, Boston, Philadelphia, Chicago and either Los Angeles or San Francisco—for two points now served by Pan Am in Germany. But the carrier did object to extensive "and beyond" rights for a German carrier to Latin America.

"When that case was pending before the Civil Aeronautics Board," said Adams, "Pan American warned that rights from Great Britain, Germany and other countries, like this dog leg operation, would have to be purchased, and that the price might be heavy. We are now beginning to see just how heavy the price is in the case of Germany, we do not yet know what it would be in the case of Great Britain and other countries."

### Sue Route Definitions

Pan American told the position that Germany shouldn't get rights beyond the United States that are going to be supported chiefly by British Freedom Flyers.

On certain routes between Germany and Latin America to Mexico, for instance—New York, it on the largest carrier. On others, the inclusion of New York makes a dog leg route. Adams

pointed out that the "Goat Circle" route linkage between Germany and Rio de Janeiro is 6,617 miles while the route via New York is 8,675 miles.

Adams said that such a route would have to subject passengers on U. S.-Latin America traffic, since passengers traveling between Europe and Latin America would go by a more direct route.

The Pan American witness expressed the hope that the Latin American route proposed for Germany can be more sharply defined and limited. He said that the United States should not choose a dog leg route for TWA in the event of a dog leg route between Germany and South America via New York.

Adams also hopes that difficulties involved in the German negotiations will lead to development of procedures in which U. S. carriers are more closely informed of what is going on.

## Gewirtz Criticizes House Monopoly View

"Freedom of entry" is no longer taken "as much a cardinal principle for the special purpose of defining personal organizations in the interest of broader appeal," Senator Gewirtz executive assistant to the president of Air Transport Assn., declared in a testimony before the House Anti-Monopoly Subcommittee. Gewirtz was speaking in charge that a monopolistic "closed door" system exists in the industry.

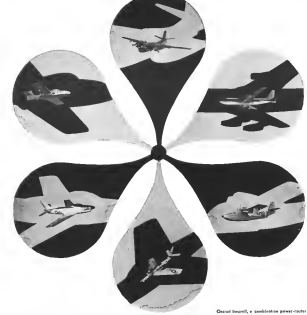
Sen. Wayne Morse (D-Ore.), Sen. Joseph O'Rourke (D-Wis.) and Rep. Henry Reuss (D-Wis.) previously presided in their testimony before the subcommittee that Civil Aeronautics Board and the scheduled airlines have created a closed door to restrict a competitive status quo and bar the entry of new carriers (AW May 16, p. 112).

Apparently referring to North American Airlines, Gewirtz said that those who have taken the "freedom of entry" banner have "combined in their own field to squander and their own little corporations." Calling the "a and a combination of monopolies," he suggested that the industry monopoly subcommittee investigate it.

"What the opponents of so-called 'freedom of entry' seek is just enough 'freedom of entry' to get their own favored route awards, limited to the most lucrative traffic routes—and then, at the door close behind them," Gewirtz said.

"The simple fact is that 'freedom of entry' does not mean 'freedom' when used by the 'freedom of entry' advocates."

"No one speaks adversely of freedom of entry in the sense the words would seem to imply—namely, that service could start airline service over any route at will," he said.



## \*Shape of things that come— from TWIN COACH

Piston or jet...single or multi-engine...trainer...interceptor...turboprop or tanker transport

—Twin Coach Aircraft Division is probably unique among America's great subcontractors in its ability to produce major assemblies for many different aircraft types.

That's because we're aircraft specialists. Twin Coach Aircraft

Division's five plants are devoted exclusively to production of airframe major assemblies. We build no other products...do no other work.

This is important because it means your airframe assemblies are built by experienced aircraft specialists...men whose one aim is to produce to specification, on schedule, at the lowest possible cost.

General tourist, a combination power-plant and jet-engine turbine that can cruise at 150 knots, minimum per minute, is just one of many hundreds of modern, high speed machines we've



**TWIN COACH COMPANY**  
Aircraft Division  
BUFFALO, N. Y.

Other divisions of Twin Coach Company make:  
BENT CARRIER TRAINERS • CANTIER, GARDNER AND PUGH AIRCRAFT  
• FARMER, LUTHER, HOBBS, ENGINES • FORD, HESTER, ENGINES

## Lockheed Electra First Flight—1957

Burbank, Calif.—Lockheed Aircraft Corp. is planning the first flight of its turboprop Electra for October 1957. First delivery of the 414 mph medium-haul transport to American Airlines is scheduled for 1958.

Before Lockheed starts delivery on America's \$65-million order for 15 of the new aircraft (AWB No. 12), they Electra will undergo simultaneous flight tests. In a minimum test work, Lockheed President Robert H. Gross and the new transport will have a top speed of about 490 mph and a cruising speed of 454 mph, a 7,000 mi range and accommodations for from 64 to 90 passengers. Performance figures are based on design proposals to power the Electra with four 5736 hp, Allison H81 turboprop engines. But Gross and the president for AA's new transport has not been finally selected.

Amendment design of the transport indicates later versions of the Electra will be able to test turboprop engines up to 5,000 hp for improved performance. Dimensions of the turboprop engine include a wing area of 1,200 sq ft, and 7.5 aspect ratio.

Lockheed has set up a production rate of 11 planes per month during the latter part of 1959. Costs and manufacturing personnel on the Electra were should increase monthly to a total cost, close of \$2,000 by the end of 1959.

## Pearson is Elected ATA President

Washington, D.C.—Harold L. (Pete) Pearson, 57, was elected president of the Air Transport Association last week (AWB May 8, p. 11).

Previously serving as assistant director of the Bureau of the Budget, Pearson assumes his new duties July 1. He becomes the fourth president of 27-year-old association of the industry scheduled earlier. He is succeeding Earl D. Johnson, who resigned after serving a 16-month term to become a vice president of General Dynamics Corp.

Pearson previously served as Deputy Under Secretary of the Army with responsibility for logistics and financial management under Earl Johnson, outgoing president.

A native of Kansas City, Mo., Pearson's business career had been in the field of merchandising and financial management prior to entering government service in 1951. In addition to work with G. P. Penney and Stern Brothers, he was assistant with Montgomery Ward from 1938 until 1945 and was vice president and treasurer from 1940.

Pearson told American Wings that the association picture is glowing out but work at the Budget Bureau is preoccupation for beginning the ATA job on July 1. He said there has been no conversation in the question of his return, but added "I hope to be there a long time. There was a mistake about asking that if you are a shareholder, you are not a shareholder and yet I don't feel long term contracts."

Pearson indicated he has no pre-conceived notions about industry problems. He said, "I'm reading everything I can get my hands on and seeing as many airline officials as possible



HAROLD L. PEARSON

to discuss their problems. Some speech making will undoubtedly be required at first as a part of the all-important job of relating responsibility to my trade association," Pearson stated.

Other ATA board of directors' action taken including the election of Robert L. Cummings, Jr., president of New York Airways, as a director by expanding the board to 11 members; approval of ATA's second half operating budget; and increasing the number of member carriers to 64 with the addition of Canadian Airlines Représentation Airlines and Northern Consolidated Airlines. The associate memberships of Pan American-Globe Airways and West Alaska Airlines were changed to full memberships.

## Airlines Will Seek Balboa Agreement

The airlines involved in the New York-South American interchanges proposed by the Civil Aeronautics Board

in the Balboa case got together last week to work out tentative agreements. The Board extended its June 20 deadline to June 30 to allow Eastern Air Lines, Braniff Airways, National Airlines, Pan American World Airways and Pan American-Globe Airways added time to work out agreements for the extension of the two proposed interchange agreements.

Originally, CAB gave the carrier thirty days to present plans for the services. Pan American and Eastern wanted until a few days before June 30 before announcing they would go ahead with the National-Pan American and Eastern-Braniff interchanges. The Board asked them to set up.

Both pairs of carriers were conducting negotiations last week to conclude agreements before the June 30 filing date.

While Eastern and Pan American were discussing whether or not to oppose the CAB Balboa decision, National and Braniff wanted out an agreement for an interchange and filed it with the Board. The agreement didn't include Pan American since neither National nor Braniff would have to operate between the Canal Zone and Miami to meet National.

Under the Braniff-National plan, National would take over Panam's aircraft at Miami on a charter basis and fly them between Miami and New York. National would operate one first class and one tourist flight daily for Panam, with provisions for additional flights.

The through flight agreement under which Panam flies between the Canal Zone and Miami over a Pan American route is contingent on the agreement reached among the carriers on an interchange and must be approved by the Board along with the interchange agreement.

## Piedmont Aviation Wins CAB Support

Extension of Piedmont Airlines' route between Washington, D. C., has been recommended by Civil Aeronautics Board Executive Richard A. Wolf.

While economic assistance of Piedmont's conflicts in authentic service between Lockheed V-6, and Washington via Charlottesville V-6, for an experimental three year period. He suggests that Piedmont be prohibited from operating interchanges between Washington and Norfolk V-6, and Western Sales and Greenville/High Point, N. C.

The application of the City of Richmond, Va., for an interchange would be denied under the carrier's recommendations.



## From the Ground Up...

UNSURPASSED ACCURACY WITH Collins VOR



COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA

1515 H-100 Drive, DALLAS 2, TEXAS  
1741 W. Olive Avenue, SUENBURG, CALIFORNIA  
241 Madison Avenue, NEW YORK 17, NEW YORK  
1300 14th Street N.W., WASHINGTON, D. C.  
COLLINS RADIO COMPANY OF CANADA LTD.  
76 Sparks Street, OTTAWA, ONTARIO





Tail section of North American P-51

## vacuum-melted metals for "hotter" engines...

Vacuum-melted metals are breaking the "thermal-metal barrier" of jet engine design. For they make possible higher engine operating temperatures, under conditions where conventional alloys fail rapidly.

Turbine blades of vacuum-melted superalloy, for example, were tested together with comparable blades of air-melted alloy. After 40 hours of operation the air-melted blades broke when bent less than 90°... the vacuum-melted blades took a full 180° bend without failure! For main shaft ball bearings, too, vacuum-melted metals far outperform conventional alloys.

How's why... VACUUM MELTING LITERALLY SUCKS GASEOUS IMPURITIES FROM THE MOLTEN METAL... REMOVES INCLUSIONS AND GASES THAT LIMIT

THE PERFORMANCE OF CONVENTIONAL AIR-MELTED ALLOYS. RESULT: FURTH MOREVIALS WITH EXCEPTIONAL PROPERTIES... LONGITUDINAL AND TRANSVERSE UNIFORMITY... HIGHER CREEP AND STRESS RUPTURE STRENGTH... BETTER DUCTILITY AND FATIGUE STRENGTH.

Vacuum Metals Corporation, pioneer in the development and production of vacuum-melted and cast alloys, is producing these unique new metals designed for a wide variety of aircraft applications. If you have a metals problem that vacuum-melted alloys might solve, please describe it in as much detail as possible. Write Vacuum Metals Corporation, P. O. Box 577, Syracuse 4, New York.



**VACUUM METALS CORPORATION**

Jointly owned by Crucible Steel Company of America and National Research Corporation.



LAUNCHING of 28 man life raft from "ditched" 40-4 takes 35 sec.



VOLUNTEERS EVACUATE from ditched and grounded 40-4 rafts.



CROWDED RAFT leaves place 307 miles after test began.



ALL 40 EVACUEES are in single raft. Other raft inflated as ditched.

## CAA Tests Ditching

Norfolk, Va.—Requirements for faster evacuation of passengers from ditched transport planes and improved survival equipment were studied by Civil Aeronautics Administration during simulated trials at sea near here recently.

Fifty CAA volunteers, including 33 women, played the parts of typical airline passengers during Operation Ditch. A Martin 40-4 lifeboat lowered with steel drags, provided the stage setting for the study.

Crewmen recorded the time it took passengers to escape into the Garrett Corp. Air Cushion Division's 28 man life raft, free the raft and close it from the "swinging" plane.

Operation Ditch is part of a continuing program by government and industry to improve emergency procedures and survival after water landings.



AS RAFT FLOATS AWAY from bargeoff Martin 40-4, a "survivor" is pulled aboard.





## EDITORIAL

### The Poisonous Fog of Censorship

A strong tide of vigorous criticism from all segments of the American press and many portions of the aircraft industry is beginning to engulf the efforts of R. Karl Housman to establish poisonous censorship in the Pentagon.

Recent editorials in the New York World Telegram and the Washington Post and Times Herald attacked the new Pentagon policy. A distinguished leader of the aircraft industry, Frederick B. Rentschler, chairman of United Aircraft Corp., commented sharply on the absurdity of present military information restrictions.

Mr. Housman, a Bell Laboratories' executive, has embarked on a government career based on pursuing a policy of official censorship of unclassified military and technical information. We have watched Mr. Housman's Washington career closely from the time a few months ago when he joined the Commerce Department as the head of its Office of Strategic Information until his recent appointment as Deputy Assistant Secretary of Defense for Public Affairs. During this brief period we have seen his policy change from a publicly expressed aim to see that more information was made available to the American press and people to his latest sedulous attempt to establish himself as the poisonous censor of the Pentagon.

Before the advent of Mr. Housman at the Pentagon, most of the public relations problems—and there were many—concerned the exact point at which the line of military security classification should be drawn. An admittedly difficult problem requiring the considered judgment of technically qualified people, it has never been solved satisfactorily.

However, Mr. Housman opened the genuine problem and played individuals into an effort to restrict the flow of unclassified information from the Pentagon. In this effort he had support from Mr. Charles E. Wilson, the Secretary of Defense, who appointed him to the Pentagon job. Secretary Wilson slowly had established a policy that nonclassified information should be withheld from the public if it did not make a "constructive contribution" to the Defense Department mission.

Now, Mr. Housman has gone even further in the direction of poisonous censorship. To Secretary Wilson's "constructive" yardstick, he has added the criterion that information must be "useful, valuable or interesting" before the Defense Department will make it available to public and press. Who will be the judge of whether information is "useful, valuable, interesting or constructive"? Why Mr. Housman, of course!

By his latest policy statements, expressed in letters to J. Russell Wiggins, managing editor of the Washington Post and Times Herald and chairman of the Freedom of Information Committee of the American Society of Newspaper Editors, Mr. Housman attempts to tell the American public what they can and should read about their national defense effort. He also is attempting

to tell every editor of an American publication what he can and should print about the vital defense.

No citizen worth his salt will accept Mr. Housman's latest policy on Defense Department information. Nor will the American public stand for a Pentagon bureaucracy deciding what they can or should know about one of their government's most important missions.

The sordid tale of how this policy was used to conceal the accurate and complete story of the Russian exposure display over Moscow is still fresh in the public mind. Now absorption emanates from the Pentagon even day.

Although even Russians in Moscow and hundreds of foreign observers had an opportunity to see the new Red Air Force jet fighters and bombers two months ago, the Pentagon still will not release pictures of these aircraft to the American public.

Although pictures of the great Martin PBM Sea-Master have been officially released by the Pentagon, it is trying to keep secret the last flight of this huge plane powered by four burning turbojets with hand-pumped afterburners as it speeds over Baltimore (population 1,357,571).

Although the Northrop Snark and Bell X-4 rocket guided missiles have been paraded on public airports on occasions stretching back more than a year ago and although the Air Force has officially declassified external pictures, the Pentagon is still trying to keep these pictures from the public.

Although the Pratt & Whitney J57 has been produced by the thousands, has been in widespread service for several years, and is handled by thousands of mechanics and directed and overhauled by thousands more people, and although thousands of copies of its unclassified technical manuals have been printed and distributed by USAF and Navy, the Pentagon still treats this engine as an official secret.

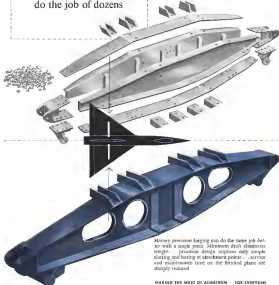
The poisonous fog of censorship that is settling over the Pentagon at the direction of Secretary Wilson and his aide R. Karl Housman will have serious effects on the aircraft industry if it is not checked soon. It will further retard our technical progress in answer to development; it will complicate aircraft firms' relations with their stockholders and it will severely handicap American industry in its international competition.

The Wilson-Housman information policies have no place on the American scene. We agree with Managing Editor Wiggins when he asked Mr. Housman and the American press to announce a declaration that Thomas Jefferson made in another national crisis 157 years ago:

"None believe divine that they have a right to tell information in a case of such great concernment to them. It is their worst which is to even all the expenses of the war and their blood which is to flow in expiating at the cross of R."

—Robert Heitz

### Harvey precision forgings... making one part do the job of dozens



Here's an aircraft beam... made the old way. Each one of the pieces you see must be hand-fitted separately, brought to an assembly area, laboriously put together with operations of 40 bolts, almost 200 rivets. And it's only one of many similar beams in a typical modern plane.

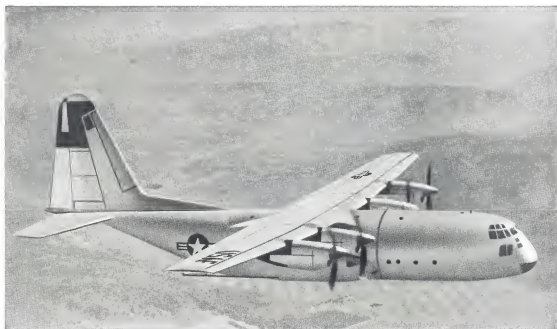
Harvey precision forging can do the same job too. In one single piece. Minimum draft eliminates weight... precision design requires only simple slating and boring in attachment points... service and maintenance time on the finished plane are sharply reduced.

MAKING THE MOST OF ALUMINUM... FOR EVERYONE

**HARVEY**  
Aluminum

RESEARCH DEVELOPMENT PRODUCTION  
Harvey does all three in a leading independent position of aluminum refineries in all fields and all types special extrusions, pipe, forgings, further extrusions, semi-finished and cast, forging, sheet, pipe, valves, impeller castings, which from these various products and special products. Also similar products in alloy steel and titanium as application.

HARVEY ALUMINUM SALES, INC., TORRANCE, CALIFORNIA—BRANCH OFFICES IN PRINCIPAL CITIES



## First Flight of the **Hercules** powered by America's first production Turbo-Prop engines

A NEW era in America's military transport operations was opened when the U.S. Air Force's first production Turbo-Prop cargo transport, the Lockheed C-130A Hercules, took off from Dobbins Air Force Base, Georgia.

Powered by four Allison T56 Turbo-Prop engines, the 54-ton transport was air-borne eight seconds after the brakes were released and climbed to 2,500 feet by the time it passed over the end of the 10,000-ft. runway. Test Pilot B. A. (Bud) Martin said: "It is the finest flying airplane I have ever operated."

Developing more than 2.3 horsepower

per pound of engine weight, and with a frontal area approximately half that of present transport piston engines, the 3750-h.p. T56 gives the four-engine Hercules a speed exceeding that of many World War II fighters.

A commercial version of the military engine — the Allison Model 501 — will bring new standards of faster, quieter, more comfortable air travel in airliners that can operate from any airport now served by commercial air carriers. And, with its economical use of lower-cost fuel, this new engine will substantially

reduce the operating cost of the all-cargo transport.

These great new Turbo-Props reflect the knowledge Allison has gained in designing and building gas turbine engines which have flown more than six million hours. These engines are daily flying the equivalent of one hundred trips around the world—*experience where it counts most—in the air.*

ALLISON Division  
of General Motors  
Indianapolis, Indiana  
Builder of Turbo-Jet and  
Turbo-Prop Aircraft Engines



**ALLISON**  
**TURBO-PROP ENGINES**

American built for the new era in air travel

Opportunities for engineers in Allison's \$75 million expansion of aircraft engine research and development facilities. Write: Technical Employment Section